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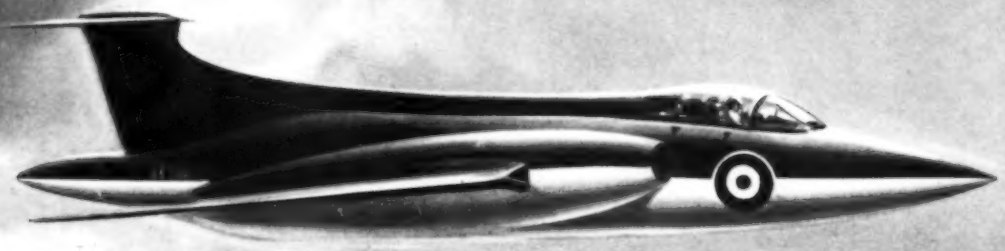

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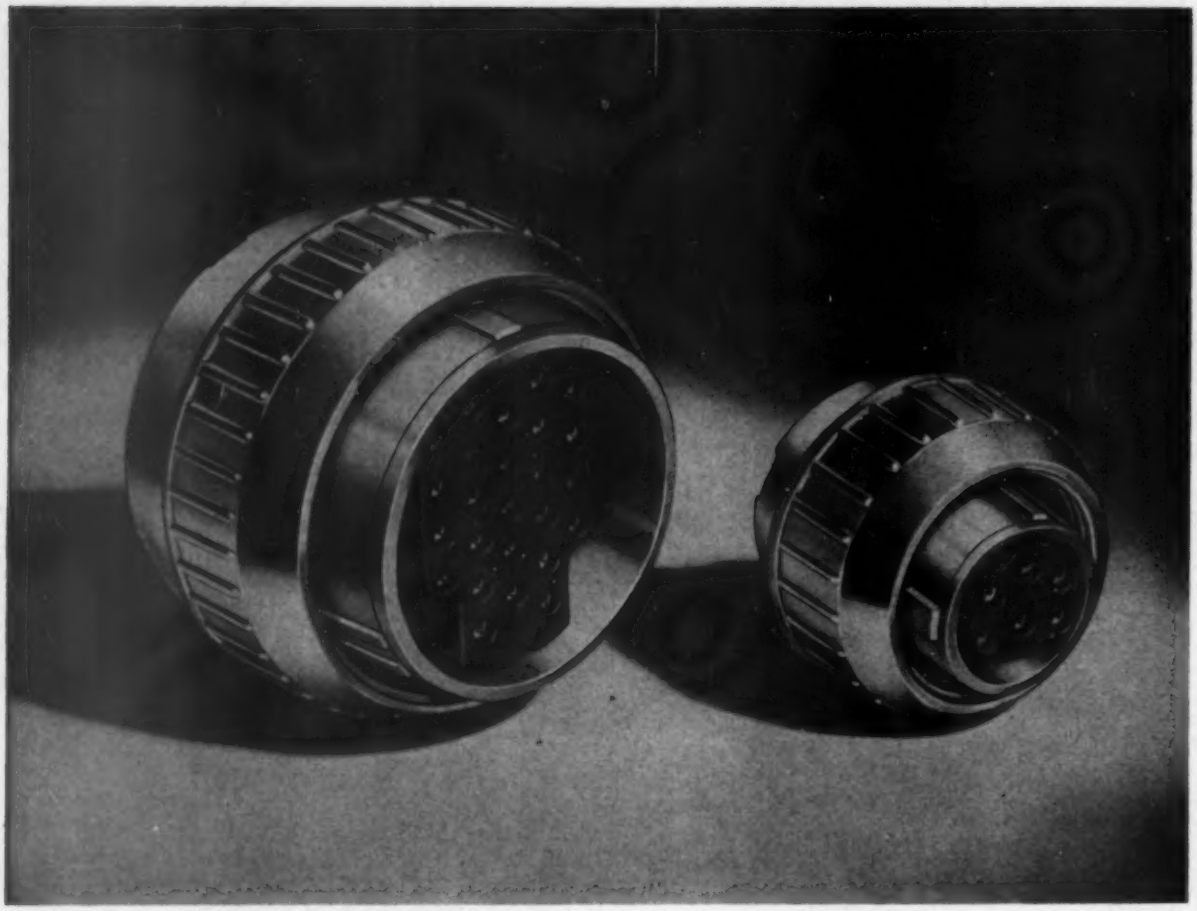

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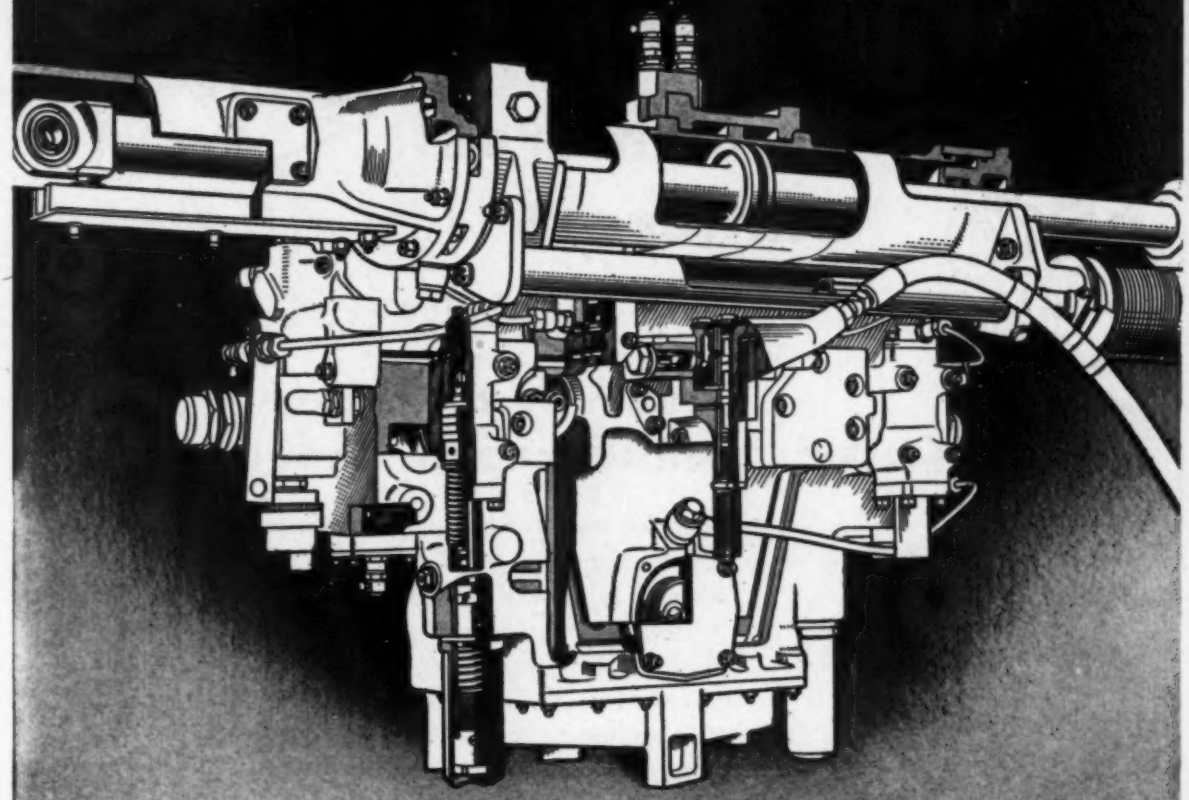

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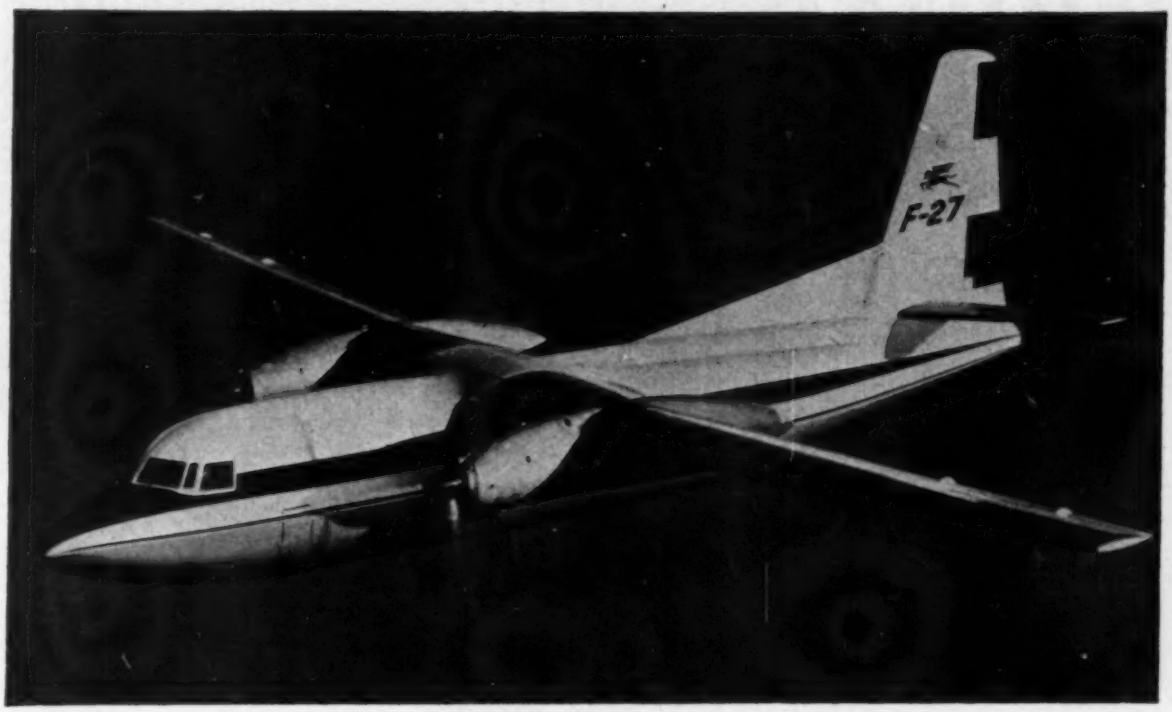

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FLIGHT
and
AIRCRAFT ENGINEER

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America's Triple Crown

TO the American nation, and especially to the not inconsiderable portion of it represented by the Lockheed Aircraft Corporation, the British aircraft industry dips its colours (still strongly flying, though beleaguered). For the first time since international records began to be "homologated" by the Fédération Aéronautique Internationale in 1905, and subject, of course, to confirmation by that body, the products of a single manufacturer—Lockheed—today stand paramount on the pinnacles of distance, altitude and speed.

Each of these achievements has a technical significance transcending the glamour of mere prestige. The distance record—*distance en ligne droite sans escale* as the F.A.I. Bulletin has it—is especially remarkable in having been established as long ago as October 1946. Thus, for over eleven years a Naval patrol aircraft of standard type and powered with piston engines has defied the successive challenges of pure-jet, turboprop and by-pass powerplants. Only the Napier Nomad—a supercharged, compounded, heavy-oil, two-stroke, interred at Acton in 1954—might conceivably have regained the laurels for a British brow. Such, however, was the course of technical development that the garland graces even to this day the venerable neck of *The Turtle*, a Lockheed Neptune P2V, engined with "up-and-down" Turbo-Compounds by the Curtiss-Wright Corporation. And if, with its eight-jet Boeing B-52G, the U.S. Air Force can at last manage to outrange the Navy's old shellback, it has yet to stick its own substantial neck out and prove it.

In *The Turtle's* endearing and enduring record we behold for the last time the classic formula (high aspect-ratio and extreme fuel economy) for the attainment of ultimate range. Yet what fabulous metamorphoses are seen in the circumstances of the other absolute records—those for altitude and speed—lately gained by Lockheed F-104A Starfighters. Time was when altitude, like range, was to be won only with abundance of wing area and maintenance of power at height, first by supercharging and latterly by rocket boosting. Yet here is the Starfighter, with no wing worth mentioning and with no augmentation for its General Electric J79 turbojet other than ram and reheat, ascending to 91,249ft in Service trim.

No Loitering

It must not be supposed, of course, that the Starfighter was capable of tactical manœuvres at that 17-mile level, nor indeed within some thousands of feet of it; and that it could not have been loitering thus loftily is clear from the disclosure that it was airborne for a mere twenty-seven minutes. Yet its almost ballistic ascent to a height over 11,000ft in excess of that but recently achieved by the rocket-powered Trident is a feat to command the acclamation of the world.

As for the Starfighter's new speed mark of 1,404 m.p.h., this is rather less of a surprise, for it had long been known that Lockheed was urgently desirous of establishing such proof that the F-104 is "the world's fastest jet." Earlier implementation may have been debarred by security, and possibly by deficiencies of control; for that piloting of an extremely precise order is necessary at speeds in excess of 1,000 m.p.h., if F.A.I. demands are to be met, was evident as long ago as March 1956, when Fairey's F.D.2 achieved its historic 1,132 m.p.h. (That record, it is not inappropriate to recall, stood for over eighteen months.) Perhaps the most astonishing aspect of the two new records is that the Starfighter's maximum level speed was actually equalled *on the climb* to the record height.

Thus confronted and confounded by science fiction that has become recorded fact, we must remember that in the annals of the F.A.I. it is still the men and not the machines to whom world records are ascribed. So, provided that the Russians do not meanwhile get busy with one of their Fishbeds or Fishpots, we shall soon be seeing the names of Major Howard C. Johnson and Capt. Walter Wayne Irwin set down on the first page of the F.A.I. Bulletin, respectively against *altitude* and *vitesse sur base*. They will find themselves in company with Commander Thomas D. Davies and his merry men, whose *Turtle* has remained so truculent over the years in face of fleeting wonders.

FROM ALL QUARTERS

Future of the Industry

WHEN the House of Commons debated the aircraft industry on May 22, the Minister of Supply, Mr. Aubrey Jones, said that there were in his view two fundamental reasons why it must contract. The cold war meant "long, protracted trouble" rather than a sudden overthrow of the balance of power; and manned aircraft were giving way in some applications to the unmanned missile, which did not employ so many people as far as the industry was concerned.

Mr. Jones, whose speech followed an opening one for the Opposition by Mr. George Brown (Belper), went on to refer to the Defence White Paper of April 1957 which had "deleted from the research and development programme two projects—a supersonic strategic bomber and a supersonic fighter"; but there were other contexts in which manned aircraft would still be needed. It was significant that this country had pioneered the turboprop aircraft, which "shows possibly greater profits than any other kind." He thought many of the questions posed by Mr. Brown called for "a determination by the Government of the proper priorities . . . and how it is to choose between them."

The first question was the pattern of the industry—fourteen major airframe firms and five major aero-engine firms. The volume of business ("as I can foresee it in the light of the estimates available to me") was not such as to sustain more than three or four major airframe and two major aero-engine firms. What was needed was strengthening of the individual firm; and the Minister did not think this would come about if the industry were left entirely to itself: the proper answer was "something intermediate between full Government authority and complete *laissez faire*"—impulse from above compelling the assumption of responsibility by the industry itself. One way in which this could be done was to place contracts "not with the mere winner of a design competition" but with a firm which showed it had something additional to offer in development, production and financial strength. The "ideal standard" was a firm engaged in both military and civil aircraft.

The Minister then went on to speak of research and development. The greater part of research had always been done by the Government, chiefly for military purposes; and with the coming of guided weapons, what was to happen to research for civil aircraft? The industry was not equipped to undertake it; yet not to do so would mean in effect the industry being deprived of its future. The Government would continue to be responsible for this research, partly in its own establishments and partly by means of contracts.

On the Vickers project known as the Swallow, the Minister said that the company's proposals—for a research aircraft which might prove the foundation for a bomber to succeed the supersonic one—had come to him on "the very eve of" the 1957 Defence White Paper. The supersonic bomber had been cancelled for reasons given in that document; so he had informed Vickers that the proposal in the form they had couched could no longer rank high on the list of priorities, but the M.o.S. was still extremely interested in the principle of variable geometry and invited the company to submit alternative proposals.

[Both the Minister of Supply and the Prime Minister answered questions in Parliament last week about this project. Since the withdrawal of Government support the company had continued the project at its own expense. The Ministry had been keeping in close touch with its work and considering the possibility of other practicable applications. Mr. Jones added that the Americans were considering whether to include a project "incorporating these principles" in their Mutual Aid Programme, but had not yet reached a decision. In answer to a question on May 20 the Prime Minister said that—apart from the possible U.S. project—there was no proposal to have the work continued in any other country.]

On development, the Minister said he did not share the view that the Government ought to contribute; though epoch-making designs might be impossible without some Government support.

At the end of the debate the Parliamentary Secretary to the Ministry of Supply, Mr. W. J. Taylor, said that the industry should do two things about contraction—reorganize itself into larger and more powerful groups and (in the case of individual firms) seek a diversity of interests. He said that the "programme of intensive research" on a supersonic civil transport aircraft was being carried out under the aegis of the R.A.E. Farnborough, and this programme would continue so long as it was necessary and fruitful. "If it is established that a supersonic airliner can be an economic proposition, consideration will then be given to the question of its development."

AW.650 TAKES A DIP: One of the first structural tests Armstrong Whitworth made of their new A.W.650 transport (see page 752) was of a special 10ft representative section of the fuselage. It is seen here being immersed in the test tank at Baginton.

SC.1 Progress

ON May 26 the Short SC.1 VTO research aircraft made its first vertical take-off in the test gantry at Belfast. Flown by the company's chief test pilot, Mr. Tom Brooke-Smith, the aircraft rose and alighted several times within the limits imposed by its tethering cables. The aircraft has already flown conventionally, from Boscombe Down. It is powered by five Rolls-Royce RB.108 turbojets.

Comets for C.P.A.L.?

THE name of Canadian Pacific Airlines has been associated with the de Havilland Comet since, nearly a decade ago, Mr. Grant McConachie, C.P.A.L.'s president, ordered two Comet 1As. It now appears that Canada's independent national airline, which has domestic trans-Canada services in prospect, has resolved its jet re-equipment problems (discussed in *Flight*, February 28). According to Mr. McConachie, C.P.A.L. have decided to order ten Comet 4s with an option on a further 15. If this order materializes—de Havilland can as yet offer no comment—it should carry Comet 4 orders (now 31) hearteningly close to the break-even point.

B.O.A.C. Comet Atlantic Plans

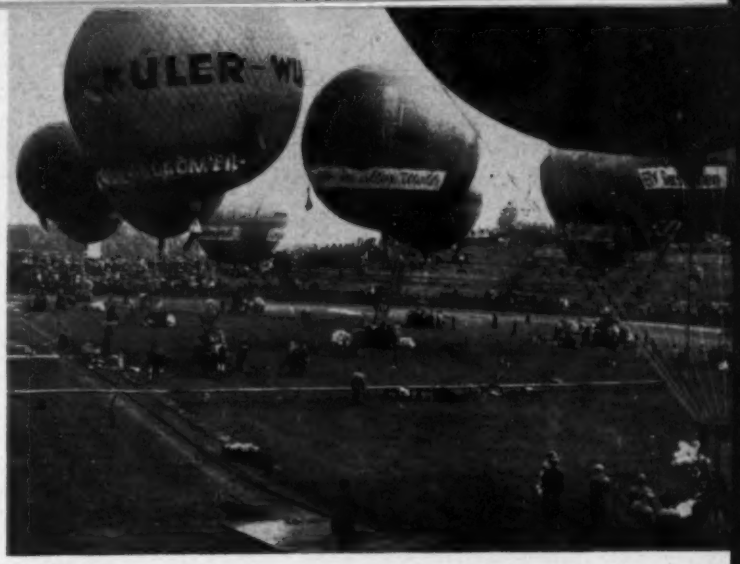
AS a continuation of its crew-training programme with its Comet 2E, B.O.A.C. is now extending familiarization to the Maritime Provinces and New York areas. Two flights are being made each week from London Airport to Gander, whence the aircraft is visiting Moncton (New Brunswick), Sydney (Nova Scotia), Goose Bay (Labrador) and Stephenville (Newfoundland).

From about June 20 the local flights from Gander will enter the New York area. Practice will include instrument let-downs and low overshoots at Idlewild and Boston and on some flights landings will be made at Baltimore and at Montreal.

More Sputnik 3 Details

FOLLOWING the initial announcement of the launching of the third Soviet artificial Earth satellite on May 15, further details were given of the satellite's launching rockets and its instruments. Among a number of statements by Russian scientists, Prof. A. Sternfeld said: "The simplest reckoning will show that to launch so big a sputnik it was not enough to couple two multi-stage rockets of the type used to send up the second Earth satellite. The new rocket is apparently a much more perfect and far more powerful device than its predecessors . . ."

Prof. Sternfeld continued by saying that the third Soviet satellite "could well be inhabitable"; in size it came close to a component of an inhabitable space station. The only problem remaining was that of bringing it back to Earth. "It has been calculated, on the other hand, that if the satellite were to be replaced by an ordinary one-stage rocket of the same weight, fitted with all the necessary scientific equipment and capable of



***THREE PICTURES TELESCOPE TIME:** This trio of news photographs, oddly enough, reflect almost the whole history of aeronautics. At the top is lighter-than-air-flight, a marked revival of which is becoming apparent; the picture shows the start of a balloon race on September 18 from Augsburg, Bavaria, in which 14 competitors started. In the centre illustration some of the earliest heavier-than-air machines (Lilienthal glider of 1896 and Wright biplane) are seen alongside a pioneer jet aircraft, the Messerschmitt Me 262; they are in Munich Museum, recently reopened after war-time destruction. At the bottom is the first picture of Convair F-106A Delta Darts in production, typifying the new generation of "all electronic" military aircraft.*

developing a speed of a bare 3½ km/sec, it could make a flight to the Moon, Mars or Venus."

Magnetometer measurements in Sputnik 3, another report stated, would give information on the structure of the outer fringe of the geomagnetic field and the distribution of electric currents in the ionosphere and upper atmosphere. This would help to confirm the distribution of force lines of the geometric field.

It was also stated that the information given by the satellite instruments for determining the electrical charge produced on its body through the action of the sun's rays would enable estimates to be made of "the corrections for the findings of the instruments sent down to Earth in the shape of radio signals. . . . When the next Soviet sputniks are launched, solar batteries will be the main sources of energy . . ." The correct temperature for ensuring the normal working of apparatus on board was achieved by circulating gases and altering the refractive powers of the satellite's surface.

Details of Soviet research-rocket achievements were given on May 12 by Prof. Yuri Pobedonostsev, a Soviet rocket specialist, speaking to the Polish Astronautical Society. He said that Soviet scientists had mastered the technique of "strictly controlled long-lived combustion processes in rocket chambers," which enabled them to launch rockets with great loads into space. A single-stage rocket carrying 1,500 kg (3,300 lb) of equipment had been fired to a height of 470 km (292 miles) last February, and another rocket had carried apparatus weighing 2,200 kg (4,850 lb).

F.A.I. Awards

AMONG the medals and diplomas presented at last month's conference of the Fédération Aéronautique Internationale in Los Angeles were the Federation's Gold Medal and De la Vaulx Medal to Major David G. Simons, U.S.A.F.; Lilienthal Medal to Don Luis Vicente Juez Gomez of Spain; and Louis Bleriot Medal to Kaarlo Henrik Juhani Heinonen of Finland.

Major Simon's awards were for his world absolute altitude record of 30,942 metres (over 100,000ft) in a free balloon on August 19-20, 1957. The Lilienthal Medal was awarded in recognition of the outstanding contributions to gliding made by Gomez, who was the two-seater champion at the 1952 world contests and runner-up in the single-seater class at St. Yan in 1956. Heinonen received the Bleriot medal for his straight-line distance record of 2,844 km (1,770 miles) between Madrid and Turku, Finland, on July 10, 1957, in the HK. 1 ultra-light single-seater.

More About Polaris

DURING the past six months Lockheed's Missile Systems Division have produced results with the Polaris submarine-launched ballistic missile which were not originally scheduled to be achieved until late 1959. In particular, the pneumatic firing system has been designed and proved and the first free-flight test of a vehicle has been made.

Polaris is a squat weapon, only 26ft 6in long but 54in across its cylindrical propulsion section. Inside is a curious solid-propellant, high-impulse motor (Aerojet-General now; possibly Thiokol later) ejecting through four nozzles each fitted with control deflectors. The motor casing is thin-wall steel with a u.t.s. of over 205,000 lb/sq in. When the main charge has burnt out the shorter second stage takes over, firing through the same nozzles but having vernier control and reversing. The 650 lb (hardly a megaton) warhead separates.

***SUPER TORPEDO:** Described above, a test vehicle for the Polaris 1,500-mile missile has now been fired.*

DJINN AND LIME? Transported from Le Touquet to Lydd in a Silver City Airways Freighter, this Sud-Aviation Djinn was assembled and flown on to Ipswich Airport, where it was demonstrated. It is one of two which, fitted with 44 gal chemical tanks and spray-booms, are to be used for crop spraying in this country by European Helicopters, a new firm with headquarters at Ipswich. Well shown in this picture is the Turboméca Palouste turbo-generator and its hand-starting gear.

FROM ALL QUARTERS . . .

Royal Visitor to Shoreham

DURING a visit to Shoreham last week, the Duke of Edinburgh toured the works of F. G. Miles, Ltd., at Shoreham Airport and witnessed flight demonstrations of the M.100 Student jet trainer and HDM.105 light transport prototype. Static exhibits arranged for the occasion included examples of the work of the Miles companies, Meridian Airmaps, Ltd., F. G. Miles technical publications department, Miles Development Products, Ltd., Miles Electronics, Ltd., Miles Plastics, Ltd., and Marketad, Ltd.

Durestos plastics were shown as applied in a large underwing fuel tank, a suppressed fin-tip aerial for the Vickers 544, an all-plastics, laminar-flow glider wing, a slat section for the Miles HDM.106 flap system, a container for a Cory Brothers 20-man inflatable life raft, a booster fin for the Bristol Bloodhound and many other parts, one of them chromium-plated. The slat section was balsa-wood filled, while the Bloodhound fin was moulded integrally with its metal spar and skins, internal stiffening consisting of spanwise corrugations forming sloped spars. Technical publications included the handbook drawings for Viscount and Hunter.

Miles Development Products, Ltd., exhibited chemically milled metal, precision machining and a twin-motor aircraft-servo actuator in which the two drives were so geared to the single output shaft that failure of one motor caused the other to rotate the output shaft at half speed and half power, but at the same torque. Adjustable limit-switches were incorporated. Made for the Atomic Weapons Research Establishment was a remote air-valve control for high-speed cameras in which angular positions accurate to ¼ deg could be remotely reproduced. There was also automatic photographic processing equipment capable of passing film of any size at controlled speeds through developer, water and fixer tanks held at constant temperature.

Miles Electronics are engaged mainly in the production of the Sea Vixen simulator and of procedure trainers for the Scimitar and Javelin. A system of standard "building block" components has been developed to allow construction of any simulator with the minimum of expensive one-off components. There are a standard plug-in amplifier unit, gearboxes and linear potentiometers. The last-named can be adapted to reproduce non-linear functions by adding resistances at any of a large number of tappings on the standard potentiometer. The responses of a particular simulator section can also be changed if, with modifications, the aircraft characteristics alter, simply by soldering in new resistors on the relevant potentiometer tappings—a relatively unskilled task causing the minimum of down-time. Special potentiometer cards are not required. Computation is by A.C. methods. Another important simulator is the training system for flight refuelling of Valiant, Vulcan and Victor, all three control positions being included in a single simulator.

Duncan McIntosh, recently appointed chief test pilot for F. G. Miles, Ltd., demonstrated the M.100 Student before the Duke of Edinburgh.

In addition to producing the prototypes of the Student and developing the use of the very-high-aspect ratio wing in conjunction with the French Hurel Dubois company, Miles have made many aircraft sub-assemblies for other companies. They are at the moment engaged in producing complete nacelle nose-rings for the Rolls-Royce Conway powerplants for Boeing 707s. The HDM.105, now has its limited C. of A. and plans are in hand for production of the promising HDM.106 Caravan. Powered by two 340 h.p. Lycoming GSO-480 engines, this machine offers excellent short-field performance, particularly in tropical conditions. A Scandinavian sales tour for the Student is planned for the near future.

The Duke of Edinburgh, accompanied by Mr. F. G. Miles, inspects the cockpit of the Miles Student jet trainer at Shoreham.

Long-stroke Leonides

NOW completing its first 50 hours' running at Alvis is a developed version of the Leonides that should produce about 630 b.h.p. for take-off. The well-known tuning expedient of overstroking has been adopted, i.e., the stroke has been increased by boring the connecting rod on extended centres; the same forging blank is used.

Leonides engines from the Coventry factory are now being produced at a rate of about 30 a month. Of these, about one-third are still Leonides Majors, although production of this engine is now tapering off. Alvis say that the Navy are very satisfied with the performance of the Leonides Major engines in their Westland Whirlwinds; these powerplants are being operated at overhaul lives of about 250 hr. Although Leonides Majors in the Whirlwinds for Austria may have about double this overhaul life, 250 hr is quite a satisfactory figure for Service use; R.A.F. Flying Training Command operated their Leonides-powered Provosts at this life (largely for ground-crew training purposes), although the number of hours could easily have been extended. Scottish Aviation's Twin Pioneers, for example, have just been cleared for engine lives of 1,000 hr.

The latest application for the Leonides is the four-engined Giovanni Agusta AZ-8 which has been rolled out for engine runs at Gallarate, Northern Italy, and should make its first flight by the end of this month. Alvis may see in this supply of engines for an Italian light transport and executive an augury for the future; they are considering seriously the marketing possibilities of aero engines for light executive singles or twins. There is little European competition in this field and many observers contend that there should be a wide increase in the demand for this type of aircraft in Europe during the next ten years.

The Billion-dollar League

DURING the calendar year 1957 five firms in the American aircraft industry achieved sales in excess of one billion (i.e., in America, 10^9) dollars. Their results are as follows: Boeing Airplane Co., $1,596,509,000; General Dynamics (Convair, Canadair and other companies), $1,562,539,000; North American Aviation, $1,243,767,000; United Aircraft, $1,232,919,000; and Douglas, $1,091,000,000. In each case the result was an improvement over the calendar year 1956.

FAW.8 is the sub-series designation of the newest version of the Gloster Javelin all-weather fighter. This mark is characterized by afterburners for its Armstrong Siddeley Sapphire turbojets (the revised rear end is seen in detail on the right), but otherwise, as the picture above bears witness, the new version is essentially similar to its predecessors. There are certain changes in internal equipment. The first flight of the new variant was made by Gloster test pilot John Towle (right).

Polish Appeal

RECALLING the vital help given by Polish airmen in the defence of Britain eighteen years ago when there was a shortage of trained R.A.F. fighter pilots, Air Chief Marshal Sir Hugh Pughe Lloyd, chairman of the appeal for Polish Airmen's Week (June 2-9), urges all who can to send a donation to the Polish Air Force Association in Great Britain, which since 1945 has undertaken to assist those who are partly or wholly disabled and the families of those who gave their lives. Pointing out that the financial resources at the disposal of the Association are "not great, and are strained to the utmost," Sir Hugh says that all contributions sent to him at 14 Collingham Gardens, London, S.W.5, will be gratefully acknowledged.

Canadian Aeronautical Institute Meeting

AT the annual general meeting of the Canadian Aeronautical Institute, held in Toronto this week, the W. Rupert Turnbull Memorial Lecture was being given by Dr. A. E. Russell, chief engineer of Bristol Aircraft, Ltd., whose subject was *Some Recent Aids to Aircraft Design*. Principal speaker at the Institute's dinner was to be the chairman of the Canadian Defence Research Board, Mr. A. H. Zimmerman, whose theme was the rôle of science in defence.

The technical sessions at the meeting were as follows:—

Engineering Administration.—*The Arrow Weapon System and Organization for Service Management*, W/C. D. W. Goss, R.C.A.F., Branch Head, Office of the Assistant to the Chief Aeronautical Engineer, A.F.H.Q.; *Some Applications of Parkinson's Law*, S. L. Britton, chief administrative engineer, Orenda Engines, Ltd.

Production Engineering.—*Tooling Approach to the Avro Arrow Aircraft*, E. B. Bragg, assistant production engineering manager, Avro Aircraft, Ltd.; *Problems of Precision Production*, F. W. Taggart, chief engineer, Aviation Electric, Ltd.; *Birth of an STOL Gear*, L. Vadeboncoeur, general manager, Jarry Hydraulics.

Computers.—*Electronic Computers in Aviation Industry*, G. S. Glinski, Canadian regional manager, ElectroData Division, Burroughs Adding Machine of Canada, Ltd.; *Applications of a Large Scale Digital Computer in Aircraft Design and Development*, A. O. Downing, chief of digital computing, Avro Aircraft, Ltd.; *Computer Application to Fuel System Design and Development*, J. M. Tusiewicz, chief performance engineer, Lucas-Rotax, Ltd.; *The Application of Analogue Computers to Guided Missile Design*, W. S. Kozak, computer engineer, Electronics Division, Air Armament Department, Canadian Westinghouse Company, Ltd.

Ground Equipment.—*R.C.A.F. Emergency Runway Barrier Development*, S/L. W. M. McLeish, R.C.A.F., Officer Commanding Airworthiness Projects, Central Experimental and Proving Establishment; *Weapon Systems Ground Support*, J. F. Louv, Jr., general manager, Consolidated Diesel Electric Corporation of Canada, Ltd.; *Aircraft Carrier Equipment*, Capt. C. G. H. Daniel, R.C.N., Assistant Chief of Naval Technical Services (Air).

VTOL and STOL.—*Some Aerodynamic Characteristics of Wing-Mounted Lifting Fans for VTOL Applications*, R. L. Wardlaw and N. V. McEachern, research engineers, Division of Mechanical Engineering, National Research Council; *VTOL Configuration Studies*, E. B. Schaefer, chief engineer, aircraft, and K. Irbitis, senior engineer, preliminary design, Canadair, Ltd.; *Experimental Techniques in the Development of STOL Aircraft*, Dr. G. W. Johnston and Dr. D. H. Henshaw, aerodynamicists, de Havilland Aircraft of Canada, Ltd.

IN BRIEF

President Eisenhower has approved the purchase by MATS of three Boeing 707-120s for the use of himself and senior officials. Occupying production-line positions not taken up by an airline, the aircraft will be delivered this year.

* * *

Prince Bernhard of the Netherlands inspected the Arrow and CF-100 when he visited Avro Aircraft recently. Holland, like Belgium, is said to be interested in the CF-100.

* * *

Too late it was noticed that the badge accompanying the Leonard Bridgman drawing of the Gloster Gamecock of No. 32 Squadron on page 703 of last week's issue was that of No. 32 Maintenance Unit. Apologies are tendered to the units concerned; and to Mr. Bridgman.

* * *

AGARD's aeromedical panel is to hold its 12th meeting at the Palais de Chaillot, Paris, from June 16 to 18 under the chairmanship of Lt-Col. Médecin E. Evrad of Belgium. On the basis of its discussions, the panel will if necessary make proposals for co-ordinated research within the NATO countries.

* * *

According to the American *Aviation Daily*, Northrop Aircraft are modifying a large jet aircraft to incorporate boundary-layer control for drag reduction. The programme is intended for "technical development in the overall application of low-drag BLC logistics-type aircraft." The aircraft may be a KC-135.

* * *

Italy, France and Germany are each to order 50 Fiat G.91s; and the U.S.A. will provide funds for a further 150. Italy has already placed a firm order for her first 25. The order book now stands at three prototypes, already completed, 27 pre-production G.91s (including two trainers and four reconnaissance prototypes) and 18 pre-production trainers.

* * *

Biggin Hill will be the only R.A.F. station near London to be open on September 20, in Battle of Britain week, and although it is no longer a Fighter Command base there will be a flying and static display as ambitious as any in previous years. Now the station comes under Home Command, which is responsible for the administration of the A.T.C., the display is being planned to make a particular appeal to youth. Among stations to be open in other parts of the country is Waddington—a Vulcan base.

BRÉGUET 940 AND 941

Initiation of Important STOL Programme

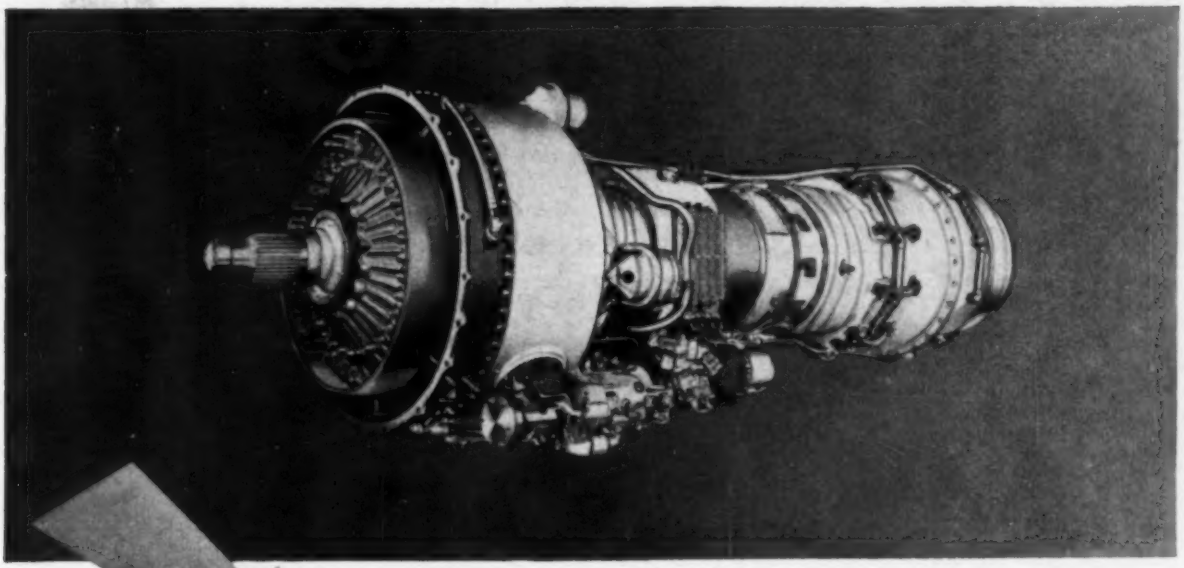
The first flight of the Intégral (above and below) was made by Bernard Witt, with M. Evrard as flight observer. The machine was airborne for 15 min at heights up to 3,300ft, and the flight was described as "extremely successful." M. Witt is seen (left) in the Bréguet Taon, in which he established a 1,000-km closed-circuit record of 649.7 m.p.h.

A MILESTONE in the history of one of the world's great aircraft constructors was the first flight, at 6.30 p.m. on May 21, of the Bréguet 940 Intégral STOL research aircraft. The Intégral uses the principle of the "blown wing" and is powered with four 400 h.p. Turboméca Turmo II turboprops. Although purely experimental, it has a loading ramp.

The four three-bladed propellers are driven by a common transverse shaft in the wing leading-edge, pitch being electrically controlled and synchronized by shafting from an actuator and synchronizer located in the centre-section. Generator and hydraulic pump are mounted near the wing-tips and also driven by the transverse shaft. Each of the engines, running at 34,500 r.p.m., drives a free turbine at 24,000 r.p.m., this being reduced to 3,545 r.p.m. and fed directly into the cross-shaft. Each propeller is driven by an extension shaft through a further reduction, maximum r.p.m. being 1,027. Nos. 1 and 3 propellers turn left-handed and Nos. 2 and 4 right-handed. All four propellers are permanently connected to the cross-shaft and run together, while the engines are connected to the system only by their free turbines. Failure of one engine therefore only reduces the power available, and feathering is unnecessary. Bréguet report that transmission friction is so low that finger pressure on one propeller blade easily turns the whole transmission and propeller system. The 12.4ft-diameter propellers are by Bréguet, and the transmission by Potez.

The makers state that if the Intégral comes up to expectations they will proceed with the 18-ton Type 941, having four General Electric T58 turboprops. They add, "The prospect of such an aircraft in the assault transport version interests NATO as well as the French and American Governments. Civil operators are interested in the cargo or passenger (40) version. . . . This plane will be able to operate from 656ft non-prepared fields. . . . To exploit this principle to the fullest, boundary-layer control devices will probably be used, for sucking and blowing on the high-lift flaps and the tail." Under the Piasecki-Bréguet agreement the aircraft would be assembled in the U.S.A. by Piasecki.

TO POWER THE CANADAIR CL-44



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The Tyne is an advanced twin spool high compression engine in the 5,000 h.p. class. It has been designed to give a very low specific fuel consumption and is backed by the unique experience gained by Rolls-Royce in more than 4,000,000 hours operation of gas turbine engines in scheduled airline service.

The Canadair CL-44 long-range transport is a development of the Bristol Britannia for Canadian requirements. The Tyne will also power the Vickers Vanguards ordered by British European Airways and Trans - Canada Air Lines.

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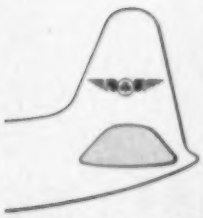
Aer Lingus, Teoranta

British European Airways Corporation

British Overseas Airways Corporation

Canadian Department of Transport

Canadian Pacific Airlines, Ltd.

Federal German Air Force

Compañia Cubana de Aviacion, S.A.

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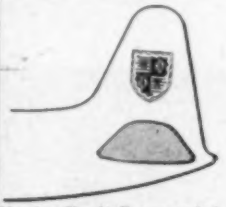

Hunting-Clan Air Transport, Ltd.

K.L.M.—Koninklijke Luchtvaart Maatschappij N.V.

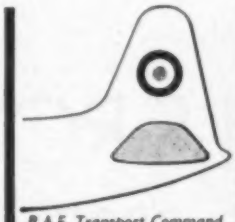
New Zealand National Airways Corporation

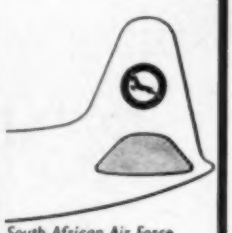
CHOSEN BY 24 OPERATORS

The performance of the Smiths S.E.P.2 Autopilot covers the entire speed range of modern civil aircraft. Offering many new and important features, including barometric height and speed control, and automatic pre-selected heading, it is already in use or on order for 24 airlines. The S.E.P.2 gives stabilised flight even in the worst of weather conditions, adds new precision to airfield approach and helps considerably in the maintenance of stringent schedules

Northern Airlines

Royal Pakistan Air Force


R.A.F. Transport Command


South African Air Force

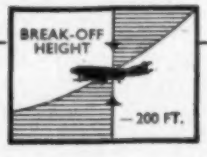
South African Airways

Transair, Ltd.

Trans-Australia Airlines

S.E.P.2 AUTOPILOT

IN SERVICE AND ON ORDER FOR 24 OPERATORS



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TGA3M 46A

A3J

A Supersonic Carrier-based Bomber for the U.S. Navy

This impression of the A3J-1 in flight was prepared by an artist of North American Aviation Inc. It emphasizes the small tail moment-arm which results from the rearward mounting of the powerplants.

AT first glance the North American A3J-1 attack bomber for the U.S. Navy, the first specimen of which was recently unveiled (as we recorded last week), appears a fantastic aeroplane to try to operate from the deck of an aircraft carrier. That such a machine can be attempted is due partly to the fact that the U.S. Navy has been able to afford the immense expense of the *Forrestal*-class of super-carriers and partly to the ingenuity of British scientists and engineers who evolved the concepts of the angled deck and the steam catapult (and, incidentally, the mirror sight).

The size of the flight deck of CVA-59 *Forrestal* is 1,036ft by approximately 150ft (the overall beam amidships is 252ft) and the others of her class are slightly larger. The ultimate carrier design, the CVA-N nuclear-powered vessel is even bigger, with 4,000 sq ft of additional deck space. All these ships are thus large enough to operate big supersonic machines of the calibre of the A3J. An equally important factor is that their decks have the requisite strength.

This being so, the U.S. Navy Bureau of Aeronautics issued a requirement for a supersonic attack weapon system in 1956. Tenders by several manufacturers led to the placing of a development contract with the Columbus, Ohio, Division of North American Aviation, Inc. This plant was given full authority to treat the new aeroplane as a complete "delivery system," and to make their own choice of accessories, systems, support equipment and sub-contractors. The contract was placed in September 1956 and was worth $86m. It covered research and development costs and the construction of a small batch of prototypes.

N.A.A.'s Columbus Division has always been closely affiliated with the U.S. Navy. Among the major programmes handled there have been the engineering and production of the FJ-2, FJ-3, FJ-4, FJ-4B and FJ-4F series of Fury fighters and attack aircraft, as well as the T-28C naval trainer and the various versions of the AJ Savage. Some hundreds of F-100 Super Sabres were built at Columbus between 1956 and the end of 1957 (production of F-100s is once more the sole responsibility of the company's Los Angeles Division), and the Ohio factory has also undertaken the entire design, development and manufacture of the T2J-1 basic trainer for the U.S. Navy. The plant has more than 3,000,000 sq ft of floor space and employment there exceeds 15,000.

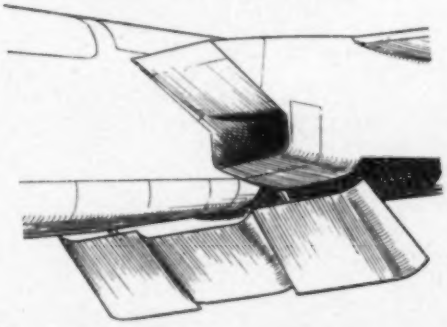
In view of its magnitude and importance, the contract for the Navy's supersonic bomber overshadowed all the other work at Columbus as soon as it was signed. The aircraft was accorded the designation A3J and, in parallel with the basic design-work, a broad programme was initiated to determine the optimum materials, accessory systems and manufacturing processes. N.A.A. are probably the most capable company in the world when it comes to the design, development and mass-production of supersonic aircraft. Reference may perhaps be made to the F-100 (Mach 1.35), the F-107 (Mach 2.2) and such giant programmes of the Los Angeles Division as the F-108 (initially Mach 3), the B-70 (also initially Mach 3), the SM-64 Navaho (Mach 3.5) and the X-15 (hypersonic). The A3J, with its design Mach number of about 2.2, therefore falls into perspective against the background of a company to whom such a weapon system is by no means the largest, nor the fastest, of their current winged vehicles.

It is, however, notoriously difficult to design aeroplanes suitable for operation from aircraft carriers, and this is particularly the case when the aircraft has to be able to deliver a megaton weapon at a range of several hundred miles at a dash performance of over Mach 2. The Columbus engineers have tackled the problem squarely and have produced an aeroplane which seems to hold few surprises. It is, in passing, worth commenting on the fact that the U.S. Navy demanded such a performance. The A3J is built for the high-level mission, and its limiting speed is progressively restricted as altitude is decreased from about 30,000ft. At sea-level it is doubtful if the performance is much in excess of Mach 1. In this, BuAer's planning runs contrary to that of the Admiralty, as we explained in our analysis of the Blackburn NA.39 on May 9.

Aerodynamically the A3J shows strong family resemblance to the F-100 and FJ-4. Compared with these aircraft the chief differences are a slight reduction in thickness/chord ratio (to about 3.5 per cent) and an increase in the relative tail volume owing to the necessity of accepting a relatively short moment-arm for the tail surfaces. The latter arises from the location of the powerplants in the rear fuselage, in ducts which strongly resemble those adopted by Avro Aircraft for the CF-105 Arrow.

The selected powerplant is the General Electric J79 with afterburner. This engine has a single shaft running in three bearings, with a three-stage turbine driving a 17-stage compressor provided with variable-incidence stators on the first six rows. Pressure ratio is almost 13 : 1, a surprisingly high figure for a powerplant which is one of the few engines designed for Mach numbers greater than 2. The first batch of A3J-1s actually have the J79-GE-2, but the future standard engine is scheduled to be the GE-4 which differs from earlier J79s in use by having a stator case and front frame in steel, as distinct from magnesium alloy. They are fed through lateral intakes which, surprisingly enough, are of a form which has not previously been employed in a full-scale aeroplane. As far as can be determined, the inclined shock at supersonic flight Mach numbers is formed by a sharp transverse lip at the upper edge of each intake, behind which is a simple wedge whose angle can be varied automatically to focus the shock on the remainder of the lip of the cowl. The inboard wall of the intake is separated from the side of the fuselage by a duct wide enough to spill off the boundary layer —which, in view of the length of the nose ahead of the intakes, must be fairly thick—and there is almost certainly provision in the lower face of the wedge (i.e., in the upper wall of the duct) for spilling off excess air through perforations and dumping

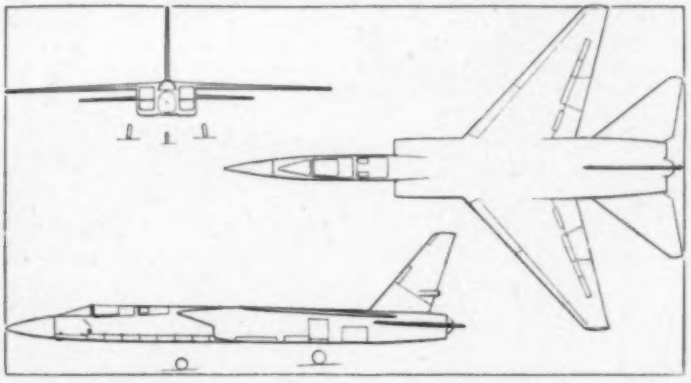
Geometry of port intake and speed brake. Operation of the intake is briefly described in the text.



North American A3J Vigilante

Two General Electric J79-GE-2 turbojets each rated at 10,500 lb thrust or 15,000 lb with afterburning. Basic particulars: span, approximately 50ft; length, 70ft; height, 20ft; design gross weight, 49,500 lb; design Mach number, about 2.2.

Provisional general-arrangement drawing.



A3J . . .

it overboard. It is probably fair to give some of the credit for this intake to the N.A.C.A.'s Lewis Flight Propulsion Laboratory, who handled much of the research associated with the intakes of the Arrow. The F-107 work is also relevant.

Little need be said concerning the airframe itself, other than that it incorporates almost every conceivable type of modern production process. It is particularly worth noting that N.A.A. have made extensive use of Magnathorium, an alloy of magnesium with 3 per cent thorium and 1 per cent zirconium, produced by the Dow Chemical Company. To meet carrier limitations, the wings and vertical tail fold; contrary to the situation which obtains in this country, overall length is apparently not critical and the A3J is not designed to fold to reduce this dimension.

Originally it was intended to use side-by-side seats for the pilot and navigator/bombardier, but each now has his own cockpit. As the photograph which we published on page 694 last week clearly showed, the two cockpits each have a large clamshell-type canopy similar to that fitted to the B-58 Hustler. Both crew members have an advanced design of upward-ejecting seat fired by a single high-velocity gun. Seat-stabilization after ejection is ensured by a folding box-kite arrangement on either side, each stabilizer consisting of three hinged fins joined at their tips by a vertical plate extending the full depth of the seat, the hinged fins folding down horizontally after ejection. Both crew members wear partial-pressure suits.

One of the most unusual features of the design is that, perhaps pending the availability of a 1,000-deg F hydraulic system, the flaps, undercarriage and speed brake are all operated by a high-pressure nitrogen system. The nitrogen is stored in bottles and is apparently re-circulated by fixed-displacement pumps to provide an infinite number of cycle operations. The nose gear is mounted well aft and retracts forwards; it has a single wheel, is steerable and carries a landing and taxying lamp. Each main gear comprises a vertical shock-strut, carrying a single wheel, mounted on parallel arms hinged about a longitudinal axis so that the whole unit can fold up vertically into a bay outboard of the engine air duct. The speed brake, which is of remarkable area, is shown in a detail sketch on page 731. Other features include a drooped leading edge, spoilers and flap-blowing.

It is doubtful if any provision is made for carrying stores externally, but the bomb bay is large enough to take all naval airborne weapons. Owing to the difficulty of releasing stores cleanly at high supersonic speeds, it is possible that they may be fired backward through a rearward-facing tube; the U.S. Navy is known to have been investigating such a system in recent months. The A3J is designed for all-weather operation and naturally carries the most advanced bombing systems, counter-measures and navigation equipment.

N.A.A. Columbus rolled out the first A3J-1 on May 15 to a schedule set many months previously. During the ensuing cermony it was given the name Vigilante by Admiral Arleigh Burke, chief of naval operations; it has been reported that Retaliator is the appelation given by N.A.A. to the land-based version which the company are trying to sell to the U.S.A.F. In December the U.S. Navy agreed to finance an extension of the runway at Columbus from 8,000 to 10,000ft to fit the airfield for A3J test-flying. Early this year a sum of $6,074,977 was voted for "construction of civil works for development and production; acquisition, rehabilitation and installation of machine tools and other capital equipment to set up an A3J-1 production line." At present the aircraft is scheduled to enter fleet service early in 1960.

W. T. G.

"OPEN YOUR GATES AND GIVE THE VICTORS WAY"

Shakespeare, King John, Act II, Scene I.

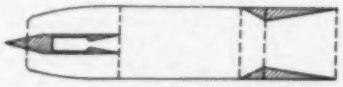
Seen on a delivery flight from its makers' Radlett airfield, in Hertfordshire, to an R.A.F. operational squadron is another Handley Page Victor B.1 (four Armstrong Siddeley Sapphire turbojets). Now under construction is the B.2 development of the Victor, with four Rolls-Royce Conway RCo.11s.

Combustion and Propulsion

POINTS FROM PAPERS AT AGARD MEETING **Part 2**

IN *Flight* last week we summarized three of the papers given at the recent "colloquium" held in Sicily by the NATO Advisory Group for Aeronautical Research and Development. Below are four further summaries, and others will appear in the near future.

M. Emile Le Grives, of ONERA contributed *Le Problème du Stato-Fusée*, what must be the first detailed statement of the ram/rocket, a scheme for a very-high-altitude M = 4.0 dual-power missile engine. This consists of a ramjet duct, in the centrebody of which is mounted a liquid rocket (50/50 furfuryl alcohol and xylidine with nitric acid) which would run fuel-rich so that the "waste" products would be burnt with air induced into the duct by the rocket efflux and speed ram.



A schematic configuration for a ram-rocket.

M. Le Grives, with some mathematics and a wealth of curves, examined the essential performance parameters under constant conditions corresponding to supersonic flight at constant altitude. A simple reference rocket, with a fuel consumption at a constant ratio to the ram/rocket was used as a "control." The calculations also included a factor representing the weight of the rocket installation in the ramjet. Both the net thrust and s.f.c. are worse for the ram/rocket than for ramjet and rocket operating as separate units; but these conclusions were reached without allowing for combustion stability or the choice of the optimum fuel and oxidant for the configuration.

Sig. Luigi G. Napolitano, Mr. Paul A. Libby and **Mr. Antonio Ferri** reviewed *Recent Work on Mixing at the Polytechnic Institute of Brooklyn*. Theoretical and experimental work on mixing flows was described and two general problems were discussed; the free mixing of semi-infinite streams, and mixing in the presence of a wall. In the first, the cases of uniform streams and of non-uniform streams involving separately streamwise pressure gradients and vorticity were considered. The fully developed free turbulent mixing of two different gases was explained and governing equations for two different assumptions with respect to turbulent transport were derived. Solutions for unity values of turbulent Prandtl and Schmidt numbers and for a parabolic density-velocity relationship have been obtained by high-speed machine calculations. On the basis of the numerical results it was concluded that turbulent mixing-velocity profiles were substantially independent of the nature of the gases, of the free-stream density ratio and of the Mach numbers. Approximate solutions to these types of non-homogeneous turbulent mixing were presented. The possibility of single parameter solutions of homogeneous compressible laminar mixing in the presence of streamwise pressure gradients was demonstrated and the pertinent equations derived. The influence of outer vorticity on the characteristics of the laminar and turbulent interaction of an incompressible, constant-vorticity stream with fluid at rest was also determined.

In the second problem, the various zones of the interaction between the mixing region and the boundary layer on the wall were discussed. For the first, wherein an inviscid core between the two viscous regions exists, a solution was presented. Preliminary results of an experimental investigation of compressible, iso-energetic mixing in the presence of a wall were also presented.

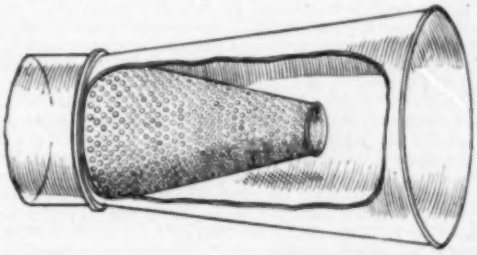
Shockwave and Flame Interactions were discussed by **Mr. George Rudinger**, principal physicist of the Cornell Aeronautical Laboratory, Inc. Part of the material in this paper was based upon work under the U.S. Office of Naval Research Project SQUID. High-speed photography (6,700 frames/sec) by Dr. G. H. Markstein of a flame subjected to shock disturbances in a vertical shock tube was used for experimental observation from which theoretical analyses of the phenomena occurring when pressure waves in a duct interact with a flame front were examined. It was observed that, when a shockwave interacts with a laminar flame, the latter emits pressure waves for a short time after the interaction in addition to the immediately established transmitted and reflected waves. The break-up of the flame due to shock acceleration was demonstrated by Schlieren photographs. The subsequent increase in flame surface is accompanied by an increased rate of combustion associated with the emission of secondary pressure waves—these being shown by Schlieren streak records. Many flames are highly turbulent, containing pockets of burned and unburned gas surrounded by relatively large zones of differential density. These pockets have a different response to wave accelerations than the surrounding gases, which result in distortion of the flame and a different burning rate—and may be a secondary source of pressure waves.

If the burning zone is short enough to be approximated to a plane-surface discontinuity normal to the flow direction, combustion can be specified by the amount of heat released and the effective burning velocity. The boundary conditions at a flame front can be derived in terms of two parameters and computing procedures are given for the interaction of pressure waves with a flame front. Most of these procedures are lengthy, but it is often possible to simplify them. Assumptions for the combustion process do not affect application of these procedures. A review of approximate analytical solutions which can be derived by the method of small perturbations was given. Mr. Rudinger concluded with a plea for carrying out similar studies with burners and research into the study of extended burning regions which can no longer be approximated to a plane flame front.

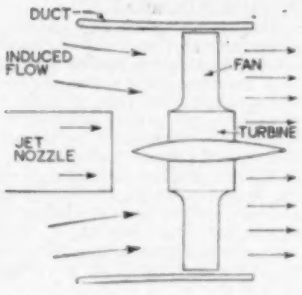
Great Britain was well represented in Group III, Noise, by **Professor E. J. Richards'** extensive and practical paper *Some Thoughts on Noise Suppression Nozzle Design*, in which he presented a clear picture of the task, the present field of knowledge, and the solutions attempted to date.

While the parameters of drag are so well understood today that its value can be calculated to within 1 or 2 per cent, the physical picture of the relationship between the kinetic energy of a jet and its total radiated sound energy (perhaps 0.01 per cent) is not. This has resulted in two diametrically opposite lines of attack; fundamental studies of noise from circular jets to confirm Lighthill's theories; and blatantly *ad hoc* experiments of every imaginable nozzle shape. "Indeed, it is understood that the initial impetus to nozzle-shape variation arose not from elaborate theory but from the noise reduction noticed when a mechanic slipped his finger into a model jet in operation!"

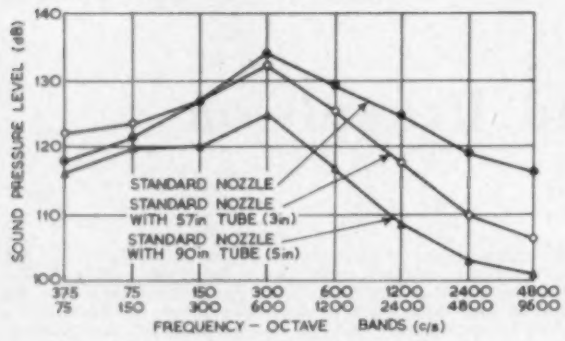
As a first approximation, acoustic power varies as the eighth power of the jet velocity and the square of the nozzle diameter, after which allowance has to be made for downstream convection of the eddies—for which basic data are not available—since noise is generated in the turbulent mixing zone between the jet and the surrounding air. The various nozzles are designed to achieve the most rapid mixing-in of cold air and therefore the most rapid deceleration of the jet efflux. This must be done with a minimum of thrust loss. The most successful general line of attack is to break the jet into multiples of smaller size, which raises the general frequency of the noise to a value where it does not carry. The Boeing multiple nozzle (as on the first 707s), the cross-slit nozzles for Fairey pressure-jets, and the "tea strainer" for the Olympus 101 are examples. This last requires a long shield to



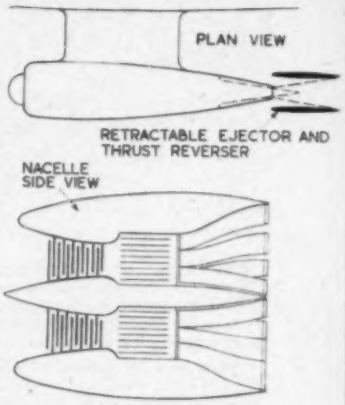
(Above) The noise-suppressing nozzle for the Bristol Olympus 101 series, mentioned by Prof. Richards.



(Right) Another suggestion for reducing jet noise—and, possibly, improving specific fuel consumption: a free-turbine fan ejector.



(Left) Rolls-Royce tests on ejector-type nozzles. Measurements were taken 50ft from the end of the silencer tube at 30 deg to the jet axis, with an efflux velocity of 1,850ft/sec.



(Right) A suggested ejector and thrust-reverser combined in a rear-fuselage engine installation.

COMBUSTION AND PROPULSION . . .

suppress the high-pitched sounds. An ejector shroud is another means of sound reduction, but to be effective must have the almost prohibitive length of four or five nozzle diameters. Prof. Richards suggested a ducted fan as the most effective extractor of momentum from the exhaust. [The scheme illustrated by the lecturer resembled that of the original Power Jets/Whittle design of *circa* 1946.]

Changing the nozzle to a slit—either an annulus or a jet flap trailing-edge—reduces the width of the mixing region and shifts the major noise output to a higher frequency. As an example of the advantageous atmospheric damping thus obtainable, whereas the English climate has a negligible attenuating effect on sounds below 500 c/s, at 4,000 c/s in 40 per cent relative humidity reductions of 4 db per 100 yd are obtainable—i.e., air viscosity alone can reduce the major noise output of a slit-jet by more than 15 db in a quarter of a mile. Aspect ratio appears to be important in the frequency-shift method—again favouring the Jet Flap.

Apart from rockets, the power radiated in jet noise is negligible from the performance aspect; internal and external flow losses (drag) in effective suppressor nozzles is not. Prof. Richards classified power losses thus: Internal losses arising from poor flow inside the jet-pipe where the shape is abruptly changed; thrust loss from any "cosine effect" (transverse deflection) when all the gas is not blown along the stream direction; increased base drag where the airflow cannot pass freely between the various sections and/or tubes of the suppressor nozzle; increased nacelle drag due to abrupt changes of shape, causing flow separation or change in M_{crit} for the nacelle; interference effect of the nozzle upon M_{crit} of the adjacent surfaces, pod mounting, wing, fuselage, etc.

Dividing the flow within the jetpipe to direct it through the suppressor nozzle almost inevitably results in some flow separation and thrust losses of one to two per cent. An exception is the Rolls-Royce Avon nozzle (a "mild" one) which gives an overall reduction of 5 db. The convergent-divergent nozzle today needed for optimum cruising efficiencies—giving 1 to 2 per cent more thrust than do convergent nozzles—put the designing of suppressors beyond mathematical treatment and into the empirical field if over-expansion and consequent separation are to be avoided.

External drag arises as base drag due to separation and reduced flow over blanked areas, as additional cooling drag, or as an alteration in the wing or pod M_{crit}. In the Boeing multi-pipe and Avon fluted nozzles there are large flow deviations which require greater transverse pressure gradients as the airspeed increases, which makes them inherently less effective as suppressors at high speed. In general, the drag of the Boeing nozzles is probably limited to the effect of the additional wetted area plus some compressibility effects at high Mach numbers. If a nozzle design is such as to cause uneven flow in the jetpipe cooling tunnel, then it will increase the cooling drag—normally of the order of 0.8 per cent. In the case of the Boeing podded installation any extension of the suppressor aft of the wing trailing edge is unacceptable, since it seriously reduces the effective sweep of the strut shock-front and with it the aircraft's M_{crit}. Here, and in some fuselage pod installations, Prof. Richards thought it would be advantageous to fish-tail the nozzle layout. [Prof. Richards was employed by Boeing as a consultant last summer.]

The experience of seven years could be summed up as: modest acoustical reductions of 7 db, possibly 10 db, by nozzle shape, the noise-reduction mechanism being by a quick reduction of velocity with a rather lower noise output if frequency raising occurs; a minimum of 1 per cent, possibly 2 per cent, effective thrust loss; marginally acceptable noise reductions on current aircraft, but inadequate suppression as thrusts become greater with larger, heavier and faster aeroplanes.

Further progress to keep pace with the rise in power will entail the drastic re-design of airframe or engines. "The first lies in the adoption of the Jet Flap principle . . . which gives not only a lower noise level, but also a greatly enhanced areodynamic performance of the aeroplane. Since the engineering and aerodynamic problems of the Jet Flap are likely to make this solution a long-term one, the second and most likely approach to the noise suppression is that which has been advocated by the noise-suppression researchers from the very commencement of their researches and is indeed the one clear-cut recommendation immediately deducable from Lighthill's theory, viz, the reduction of jet velocity. It is only quite recently that engine designers (other than Rolls-Royce on the Conway) have accepted the need to reduce jet velocity at take-off and have realized that such engines of the ducted fan or high by-pass ratio type can be designed with equal, if not better, performances than the orthodox jet engine."

Even with improved engines, noise-suppressing nozzles will be required and Prof. Richards offered some controversial suggestions based on evidence that quicker mixing is the answer, with limitation of thrust-losses the problem, i.e., an airflow problem requiring engine/airflow integration. Engine designers should be prepared to forgo the single jetpipe and accept compromise immediately aft of the turbine disc. The rear-fuselage pod suggests a high aspect ratio multi-nozzle system. The promising ejector suppressor would be of manageable two-dimensional proportions with a narrow nozzle. It should be retractable, could be arranged as a thrust-reverser and would be an invaluable shield against acoustical fatigue of the rear fuselage structure.

Many jets are already angled away from the fuselage to avoid structural fatigue, and the radial spread of multi-nozzle jets could still further increase the mixing rate. Photographs of a two-dimensional choked jet showed mixing angles as large as 60 deg aft of the displaced shock cells. At Southampton, experiments were being made to induce such spread angles in circular jets, mechanically, by shaking the jetpipe and by superimposing a high intensity, very high frequency sound field asymmetrically about the jet axis. If a jet splays on to a curved surface and spreads into a thin sheet noise is reduced. It might be possible to use retractable curved surfaces at take-off, or even direct the jets on to the under-surfaces of wing and flaps; stresses are already so high that steel skins may be used on these surfaces.

CANADA'S GOLDEN ANNIVERSARY

DETAILED planning for next year's celebrations of the fiftieth anniversary of flight in Canada is now well under way. A national co-ordinating council is working with local committees in organizing a number of air shows and other special events to commemorate the flight of J. A. D. McCurdy at Baddeck, Nova Scotia, on February 23, 1909.

W/C. Pearce, co-ordinator of the anniversary plans.

The council includes representatives of the Services, government departments, the aircraft industry and operators, and also major aviation associations such as the Canadian Aeronautical Institute and the Royal Canadian Flying Clubs Association. Service participation will include the construction of a full-scale replica of McCurdy's Silver Dart aircraft, which will be flown at Baddeck and then displayed at various points across Canada.

Officers of the council include Gordon Stringer of Canadair, president; Victor Koby of Spartan Air Services, secretary; and W/C. Harold Pearce, M.B.E., C.D., F.R.P.S., recently appointed as national co-ordinator. W/C. Pearce has recently retired from the R.C.A.F. following 31 years' service. His appointments have included command of the R.C.A.F. Photographic Establishment; Director of Photographic Survey Operations; exchange officer at R.A.E. Farnborough; Senior Technical Staff Officer of Maritime Air Command; and Chief Technical Services Officer at the All-Weather and Maritime Station at Comox, B.C.

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capacious fuselage can readily be adapted to suit
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Powered by two Napier Eland
propeller-turbines with Fairey Pressure-Jets at the
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48 passengers
185 m.p.h. cruising speed
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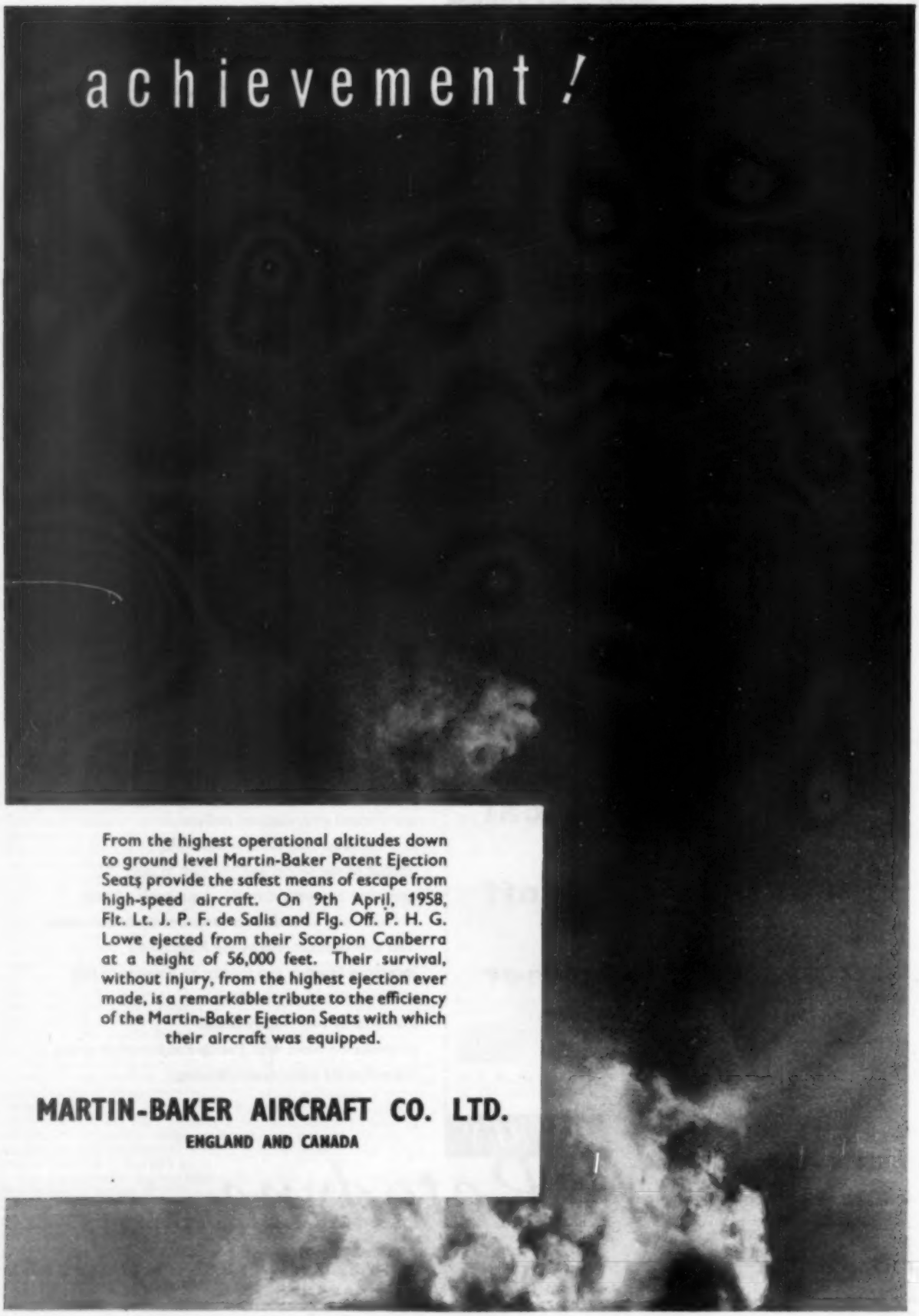

From the highest operational altitudes down to ground level Martin-Baker Patent Ejection Seats provide the safest means of escape from high-speed aircraft. On 9th April, 1958, Flt. Lt. J. P. F. de Salis and Flg. Off. P. H. G. Lowe ejected from their Scorpion Canberra at a height of 56,000 feet. Their survival, without injury, from the highest ejection ever made, is a remarkable tribute to the efficiency of the Martin-Baker Ejection Seats with which their aircraft was equipped.

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ENGLAND AND CANADA

The Morrisey Nifty 2000 is one of the types illustrated in "Experimental Light Aircraft and Midget Racers," reviewed here.

The Aeronautical Bookshelf

Experimental Light Aircraft and Midget Racers, by John Underwood and John Coler. Aero Publishers, Inc., 2,162 Sunset Boulevard, Los Angeles 26, California. Illustrated. Price $2.50.

THIS collection of 315 photographs of ultra-light aircraft includes examples from France, Britain, Belgium, Italy, Germany, Sweden, Switzerland, Canada and the U.S.A. Arranged in no logical sequence, and with captions of varying detail (in many cases the powerplant is not disclosed), the photographs nevertheless form a fascinating selection of designs both famous and obscure. Perhaps the most strikingly apparent conclusion is the amazing variety of configurations chosen by different designers to cover the two alternative requirements of economical touring and midget racing. Certainly the many sleek and fast U.S. midgets will give British racing pilots cause for deep and envious thought. Among the post-war British ultra-lights illustrated is the little-known Britten-Norman BN-1F.

The photographs are accompanied by articles on amateur aircraft construction in France, Britain and the U.S.A., a note on the Professional Race Pilots Association, a list of suppliers of plans and kits, and an index. The features on French and British activity, written by a British free-lance writer and a British amateur constructor respectively, are useful guides as far as they go: a really comprehensive and authoritative review would in each case have been more appropriate. K. T. O.

Russian Aircraft, by John W. R. Taylor. Ian Allan, Ltd., Hampton Court, Surrey. Illustrated. Price 2s 6d.

ANOTHER example of the remarkable value offered by Ian Allan in their "ABC" series. At the price of half a crown, John Taylor has come up with a packed Intelligence dossier on Soviet aircraft, splendidly illustrated with photographs and three-view silhouettes by Dennis Punnett. Here are Bosun and Bison, Faceplate and Fitter, cheek by jowl with Fagot and Farmer, Creek and Camel. And for good measure there are articles on "Does Russia Lead?", "Soviet Air Organization" and "Civil Aviation in Russia". An excellent little book in all respects.

"Low Level Mission," by Leon Wolff. Longmans, Green and Co., Ltd., 6 and 7 Clifford Street, London, W.1. Illustrated. Price 18s.

ON August 1, 1943, one hundred and sixty-three Liberators of the U.S. Army Air Force attempted to attack the Ploesti oilfields in the heart of Rumania. Fifty-four of them were shot down and scarcely one of the survivors reached home undamaged. Personnel casualties were 440 dead, 54 wounded and nearly 300 prisoners, or interned in then-neutral Turkey. The result—the flow of Ploesti oil to German industry and the armed forces was interrupted; but "within a few weeks" supplies were greater than ever. This macabre evidence supports the summing-up in this book that the operation was "the worst catastrophe in the history of the U.S. Army Air Forces."

There is material enough here for many debates—about the planning of the operation, the wisdom of choosing this particular target, the tactics, the personalities of commanders and aircrews, and the marked disapproval shown by the R.A.F. and A.V-M. Sir Arthur W. Tedder (now Lord Tedder), who was then commander of the Mediterranean Allied Air Forces. Mr. Wolf tells as completely as he can the story of the Ploesti raid, and of the policy, or lack of it, which decided that the Liberators should go ahead, even though this meant taking a large force of heavy bombers away from the striking arm of the Allied Air Forces, and losing very many of them and their trained crews.

It was a daring raid, the more so because it was doomed to disaster from the moment it was first planned and from the time Mr. Churchill and General Marshall agreed to it in May 1943. General Brereton, who commanded the Ninth Air Force, of which the Ploesti raiders formed a major part, thought that the Liberators could fly more than 1,300 miles unescorted and still reach the target undetected and at full strength. Looking back now we may recognize that the plan was utterly hopeless. But it is worth thinking more deeply. Ploesti was producing nearly all the oil the Germans wanted. If it was knocked out the German war machine would seize up. With one massive surprise raid it would be possible to stop the war. It is easy to see how the temptation to "fetch it a single powerful wallop" grew, and airmen who were tired of the war anyway might be excused for yielding to it.

So intense was the American desire to bomb Ploesti that one raid actually got away, so to speak, too soon. That was in June 1942, but it went almost unnoticed among other war news, including the Battle of Midway in the Pacific. It was little more than a nuisance raid, and it weakened the Americans' hands by warning the enemy. Ploesti's defences of fighters and flak batteries were strengthened, and when the big raid came a year later the Liberators ran into murderous opposition.

Mr. Wolff's book loses none of the drama of the operation. It provides an accurate account of what went on in the air as the raiders flew towards their target, and how the formations became ragged, some losing their way. But it is a sad story, for the reader can see that the operation can only fail. As the arguments and counter-arguments are put forward it becomes appallingly obvious that the bombers will never get through undetected and undamaged. In the light of what we know today, the plans for the raid look utterly stupid, but they were pressed relentlessly forward. The crews were briefed about how to attack the target and how to get away when they had destroyed it. But they did not like the plans. And even then there were no serious second thoughts.

The attack on Ploesti was ordered by high policy. Mr. Wolff does not heap recriminations on the heads of the local commanders. Rather he looks upon it—perhaps patriotically—as something which had to be attempted to prove that it would not work. This does not detract from the heroism of those gallant crews who took part. It just makes it clear that great measures of effort and bravery were wasted. Ploesti was one of the most difficult targets of the war; how different it would be today—a sitting duck for a handful of L.A.B.S. bombers. A. C. B.

Soviet Sputniks. Soviet News, 3 Rosary Gardens, London S.W.7. Illustrated. Price 1s 3d.

THE great amount of satellite information which had been written and broadcast in the Soviet Union between the launching of Sputnik 1 and that of Sputnik 3 has formed the raw material for this booklet. The result is a fascinating story, non-technical in style yet containing much of technical interest, and an undoubted bargain at the price. It was published before the third Russian launching.

Beginning with a note on the ideas of Konstantin Tsiolkovsky, the Russian pioneer in astronautics, *Soviet Sputniks* goes on to consider the various problems involved in launching a satellite. The satellite's orbits, the upper atmosphere and I.G.Y. research, and the approach of space travel are discussed in turn.

The illustrations include some of the most useful photographs and diagrams that have been published on the subject—and also two contrasting examples of Soviet cartoons.

Causes and Prevention of Corrosion in Aircraft, by T. C. E. Tringham. Sir Isaac Pitman and Sons, Ltd., Pitman House, Parker Street, Kingsway, London, W.C.2. Illustrated. Price 25s.

UNPROTECTED metals tend to revert to their natural salts; that is a fundamental law of chemistry. The process by which this transformation occurs is corrosion, and its prevention is an essential technique of aircraft engineering. In a new book on the subject, Mr. Tringham claims with justification that a knowledge of the causes and prevention of corrosion is the responsibility of aeronautical engineers of every status.

His book is consequently not a thesis on aircraft corrosion but a practical work for practical engineers; the author explains quite simply what corrosion is, the forms that it can take and how it can be prevented. A section towards the end describes the techniques of plating and anodizing, painting and pre-treatment and methods of non-destructive testing. Other chapters deal in a straightforward manner with stress and intercrystalline corrosion and the insidious effects of fret corrosion and corrosion fatigue, a knowledge of which is essential to the structural engineer. Aircraft and engines in service, in store and undergoing salvage from salt water are also discussed.

Comprehensive in character and adequately illustrated with photographs of examples of corrosion and protection equipment, *Corrosion in Aircraft* can be recommended to all who are concerned with the engineering of aircraft. A reasonably detailed index is provided, together with temperature conversion and specific gravity tables—a rather surprising addition, perhaps included to emphasize the practical nature of the work. A. T. P.

German Naval Air Arm Equipment

Sea Hawk and Gannet Squadrons Commissioned

"Flight" photograph

AT Lossiemouth and Eglinton last week the first two squadrons for the new Air Arm of the German Federal Navy—both equipped with British aircraft—were formally commissioned. The ceremonies were attended by Herr Hans von Herwarth, German Ambassador in London (seen in the centre of the group on this page), and Vize-Admiral S. Ruge (right), Inspector-General of the Federal Navy; and the German party was accompanied by Vice-Admiral W. T. Couchman (second from right), Flag Officer Air (Home), who has been responsible for the training of the German pilots, observers, telegraphists and technicians in this country.

The squadron commissioned at R.N.A.S. Eglinton is equipped with Fairey Gannet 4s for A.S. duties; and that at Lossiemouth with A.W.A. Sea Hawk 100/101s as a multi-purpose squadron.

Both ceremonies were held under cover because of inclement weather, and at Lossiemouth, Vize-

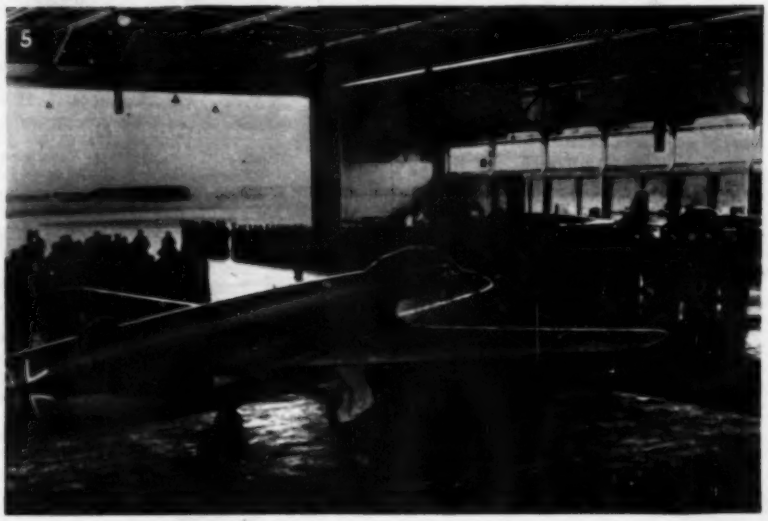
"Flight" photographs

Admiral Ruge expressed the regrets of the German Minister of Defence at being unable to attend and his thanks for all the assistance given in building up the first German Naval air squadron. "First, our thanks to the Admiralty for permission to use the training facilities and installations of the Royal Navy; to R.N.A.S. Lossiemouth, for accommodating and training our people; and to the R.N. advisory team, not only for their advice but for giving their experience and working as a team with our pilots and sailors."

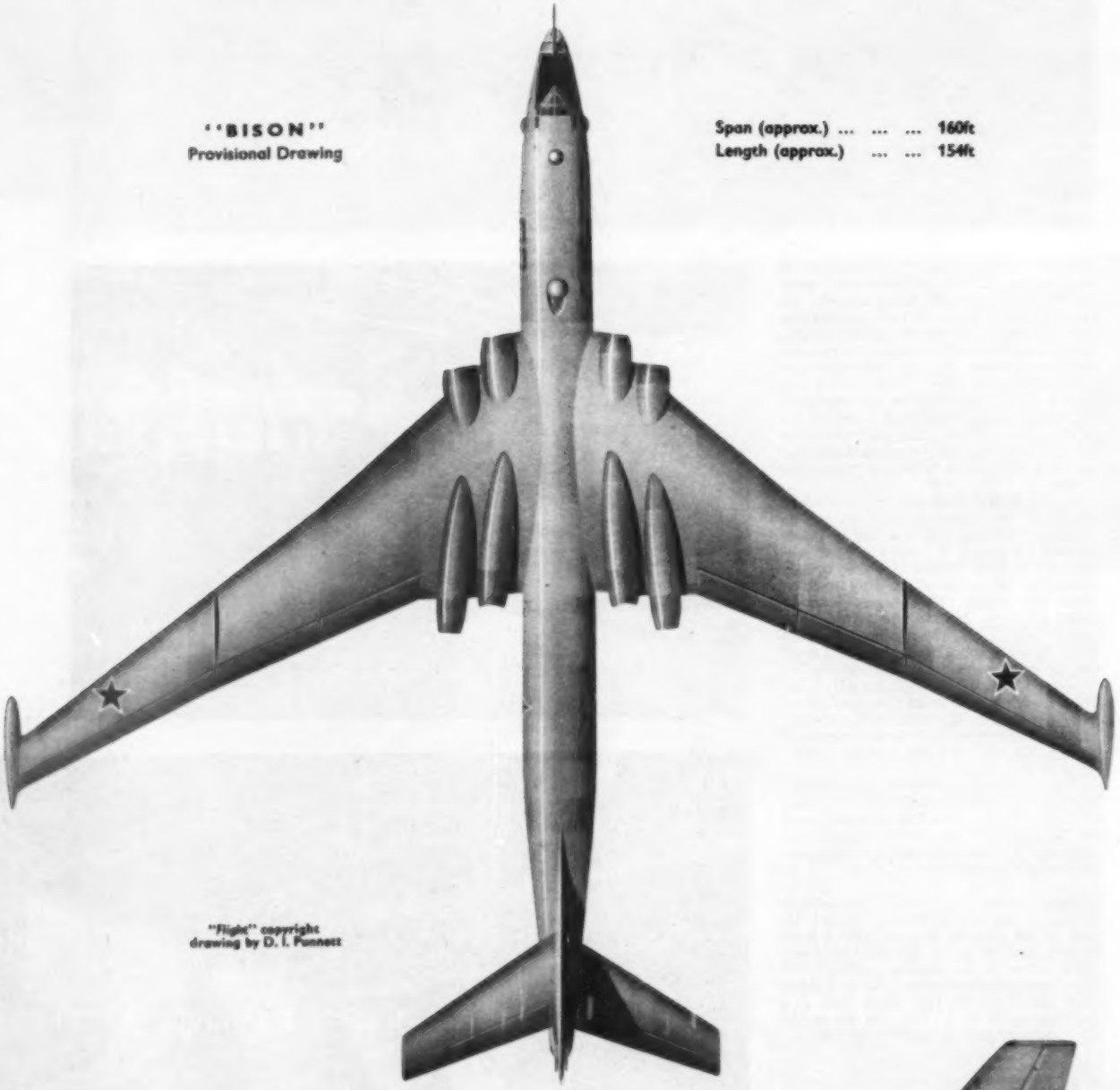
Vize-Admiral Ruge said he would like to thank Vice-Admiral Couchman personally. "We met last year when I was invited to visit R.N. training establishments," he said. "I told him very openly about the difficulties of building up from what you might call sub-zero level in some respects. He said he would help, and he has. Two years ago no one would have thought something like this would be possible at any time in the future."

Vize-Admiral Ruge said the ceremony was "a very encouraging sign, and shows what can be done if people come together, try to understand each other and work with a will. This is being greatly appreciated in my country."

The Sea Hawk squadron is being commanded by Korvetten-Kapitan P. Jung and the Gannets by Korvetten-Kapitan H. Schoepke. Both are due to leave this country for Germany during the summer on completion of their training.



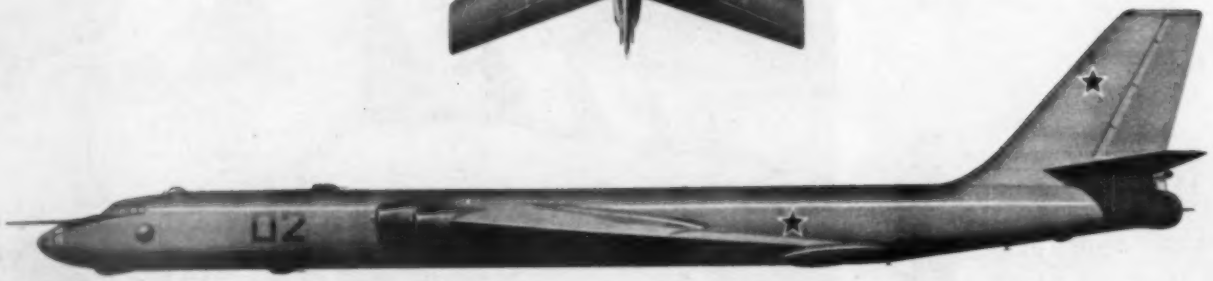
Pictures on these pages show (1) the Eglinton ceremony and (2) its leading figures; (3) one of the German Gannets plus homing torpedo and (4) one of the Sea Hawks airborne, showing its German markings; (5) the Lossiemouth ceremony; (6) a German pilot entering his Sea Hawk before a training sortie; and (7) a line-up of the multi-purpose squadron's aircraft.



"BISON"
Provisional Drawing

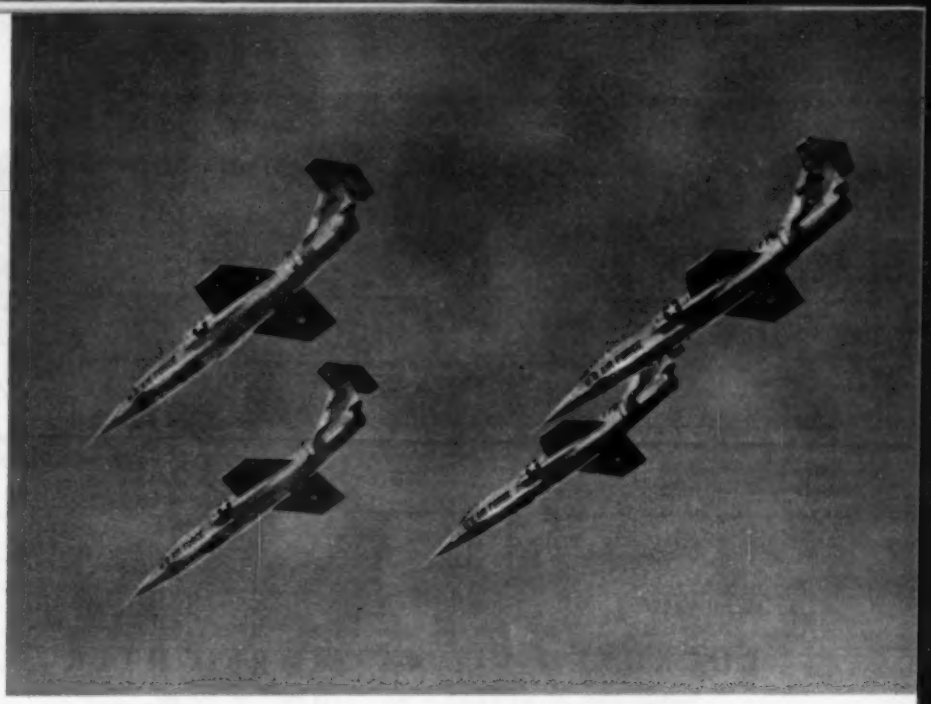
Span (approx.) 160ft
Length (approx.) 154ft

"Flight" copyright drawing by D. I. Punnett



F-104

Holder of the Absolute Records for Speed and Altitude



SUPERLATIVES should have no place in a strictly technical appraisal, particularly when they are the assertions of a publicity-conscious commercial company. It is, therefore, appropriate that this first full description of the Lockheed F-104 should appear at a time when its performance has been demonstrated by officially observed flights which promise to bring to it the world records for both absolute speed and altitude—the first time in history that both records have been held by the same type of aeroplane. The submitted figures are: altitude, 91,249ft; speed, 1,404.19 m.p.h. (about Mach 2.13).

The F-104 Starfighter is a product of the California Division of the Lockheed Aircraft Corporation. Its general configuration, which is unique among aircraft or missiles of which details have been published, was revealed in the spring of 1956. Our issue of April 20 of that year contained an extensive dissertation upon the general design of the aircraft, together with an outline of its history and basic characteristics. It is not proposed to go over any of this ground again; but, given the F-104 as an entity in being, it is now possible to comment upon much of its structural and engineering design which was previously classified as secret.

In the design of a modern high-performance aeroplane there is very little latitude in which a designer can express his own foibles and promote his ideas; and the F-104 seems to be a typical case in which a design team can explain every feature and prove that it is the only possible choice. For example, one can find standard sheet and sections in the airframe, together with shell-mould and other castings, machined skins, integral stiffening, forgings and impact extrusions, all in a great variety of materials. Throughout, the design has been most carefully planned to reduce manufacturing and maintenance costs.

Owing to the relatively insignificant volume of the wings, virtually everything carried by the F-104 is housed in the fuselage. As almost half the latter is occupied by the powerplant and its air supply ducts, it follows that the overall length is considerable; the 104 is, in fact, a full ten feet longer than a Hunter.

To facilitate manufacture, the fuselage is broken down into nose, forward, centre and rear portions, and the main centre portion is further split into port and starboard halves. As the cut-away drawing shows, there are numerous transverse frames, and many of these are very strong forgings—particularly those which carry the five main wing spars, since these frames have to absorb all wing loads and diffuse them into the fuselage. Many of the larger forgings are close-tolerance "zero-draft" pieces, requiring little finishing.

In the design of the wings Lockheed faced a particularly acute set of problems. The thickness/chord ratio of 3.4 per cent accentuated the difficulties inherent in driving powered ailerons and flaps (and, in this case, a hinged leading edge), as well as those attendant upon designing pipe-runs, electric wiring and fuel-system equipment. At one time it was thought that each wing would have to be machined from a single slab of light alloy. Another study centred upon the use of a honeycomb core, another on the use of forged or cast interior structure and another on casting a semi-wing complete. Finally a conventional structure was adopted: the major loads are taken by very thick, tapered upper and lower skins and the interior consists of simple, compression-formed channel spars and three ribs, one at the root, one at the tip and the third about midway.

As far as possible the wing is free from cut-outs. The undercarriage retracts into the fuselage, and accordingly it was found possible to run the skins continuous from root to tip. Each skin panel is step-milled, stretched to the aerofoil profile and through-riveted to the interior structure. When only one side remains to be skinned the pipes are put in to carry fuel from the tip or pylon tanks, together with weapon-system wiring for stores at the same locations. The simple ailerons are hung on multiple piano-hinges and are actuated by ten hydraulic jacks arranged side-by-side. This provides distributed forces along the length of the surface (greatly reducing aileron distortion) and permits the use of diminutive jacks capable of being accommodated within the inch or so of depth available.

Flap actuation is effected by an Eemco electric unit arranged on each side of the fuselage, driving the surface directly. A different type of Eemco actuator is used to move the hinged leading edge, which can be depressed to preserve the airflow at high angles of attack. A special feature of the 104 is its use of boundary-layer control over the flaps by compressor-bleed air (a system known in Britain as supercirculation or flap-blowing). Air from the main engine compressor delivery is taken out through two large ducts, controlled by high-temperature proportional gate valves, and led outwards to connections at the roots of the wings. These admit the air to spanwise tubes, running the whole 47in length of each flap and arranged just above the flap leading edge. In the rearward-facing portion of the tube is cut a row of 55 thin slots, each 0.09in deep, 0.55in wide and spaced 0.9in apart.

Blowing starts as soon as the flap angle reaches 15 deg, and is progressively increased until the system is at full throttle when the flaps reach their full deflection of 45 deg. Under normal conditions the flow velocity through the slots is completely supersonic at 2,300ft/sec; the system reduces the stalling speed by from 12 to 17 kt and the landing run by some 25 per cent, a typical touch-down speed for an operational 104 being 135 kt.

As was explained in our issue of April 20, 1956, the horizontal tail is mounted at the top of the squat fin. Both surfaces are built, like the wing, with heavy skins and relatively simple interiors. In addition a 5ft-long ventral stabilizing fin is fitted.

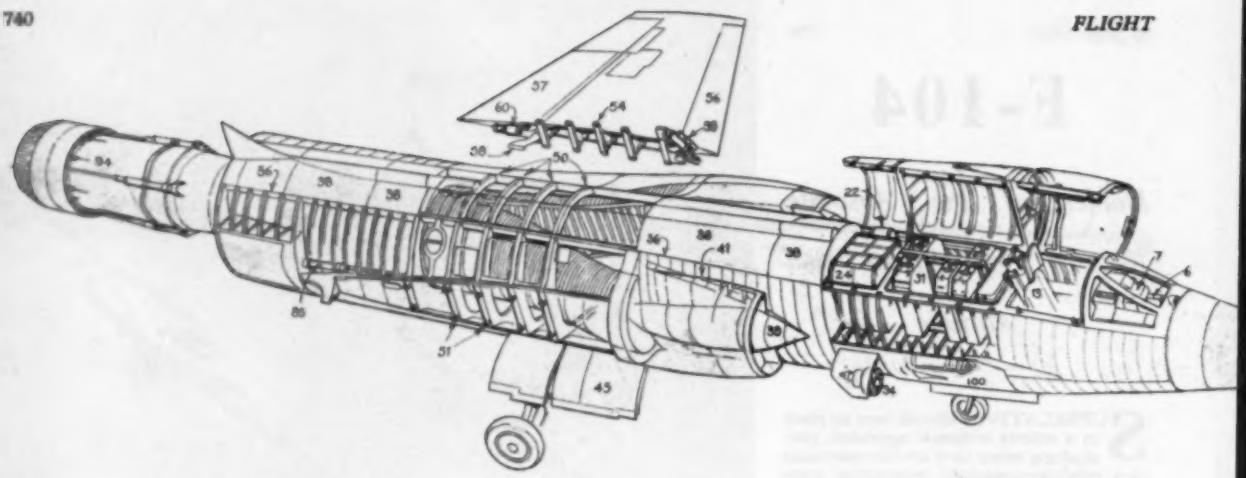
The horizontal tail is pivoted aft of mid-chord and is driven by an actuator in the fore-part of the fin. To it is attached the upper rear part of the vertical surface, which slides partially inside the forward portion of the fin-tip as the horizontal tail assumes a negative angle of incidence. Early flight-testing revealed that the 104 could, at extreme speed and altitude, enter a super-stalled condition leading to uncontrollable pitch-up. To counter this an angle-of-attack sensing unit was incorporated, which first causes stick-shake and then, should the pilot persist in pulling back, reverses the movement of the horizontal tail. The 104 is fitted with a fully transistorized three-axis autostabilizer, by Lear, Inc.

Shown well in the drawing, the undercarriage is exceptionally neat and comprises three units all retracting forwards into the fuselage (the nose gear on the XF-104 and F-104B retracts to the rear). Each main leg is a forging pivoted at its upper end and braced by a single Liquid Spring strut (Dowty patent) manufactured by the Cleveland Pneumatic Tool Co. Owing to the restricted size of the wheel bays, the tyre pressure is over 250 lb/sq in; in the past it has been customary to discard tyres after four landings but a new Goodrich sine-wave pattern promises to extend this by a factor of four.

Heart of the aircraft is its powerplant. It is remarkable that —as far as one can tell—neither the U.S.A.F. nor Lockheed have made any effort to fit the F-104 with a rocket motor. Sole means of propulsion remains the General Electric J79 turbojet, with afterburner—which, it must be admitted, is an exceptionally fine powerplant.

Some notes on the J79 appear on page 731 of this issue. It is well suited to flight at Mach numbers up to about 2.5, and in

(*Continued on page 742, after double-page drawing of the F-104*)

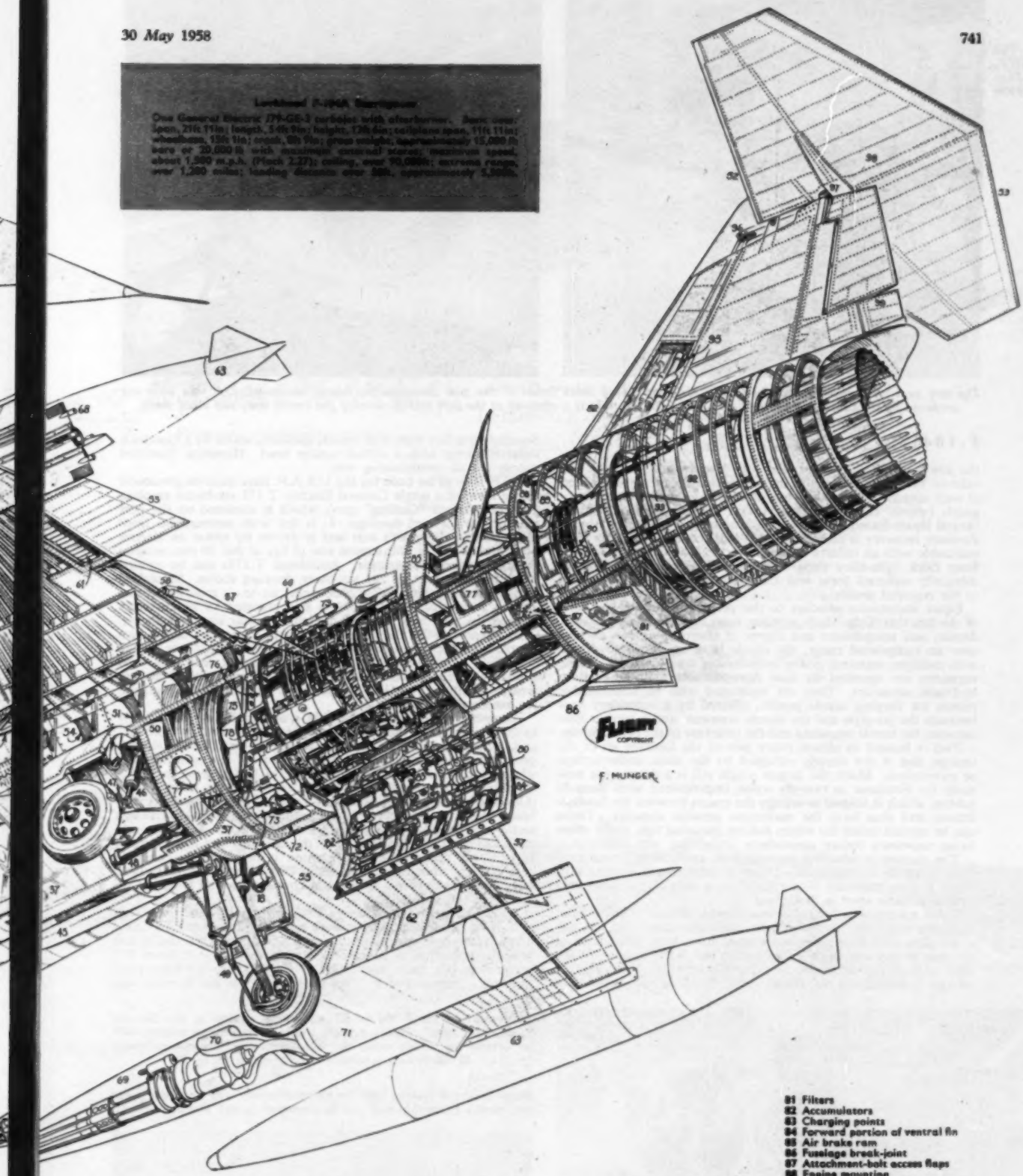


LOCKHEED F-104A STARFIGHTER . . .

1 Erosion-resistant dielectric nose, rail-mounted for access
2 Nose mounting runners
3 Packaged ASC-14 fire-control unit
4 Radar cooling air supply
5 Cooling air outlet
6 Battle camera
7 Radar gunsight
8 One-piece casting below windscreen
9 Retracting shroud
10 Radar scope
11 Angle of attack vane
12 Rear-view mirror
13 Downward-ejecting seat
14 Servicing and escape hatch
15 Radar aerial
16 Steerable nose undercarriage
17 Mechanical door linkage
18 Taxying lamps
19 Air exit louvres
20 Gun blast tube
21 Six-barrel T.171-E3 gun (20 mm)
22 Ammunition feed chute
23 Ammunition compartment
24 Ammunition tank
25 Case ejection chute
26 Gun drive motor
27 Recoil shock mountings
28 Floor to electronics and ammunition compartments
29 Supply and circuit-breaker box
30 Common shock-mounted electronics racking
31 "Jeep-can" electronics, cooled through rack supply
32 Flush aerial
33 Access to tank booster pump
34 Ram-driven emergency hydraulic pump and alternator
35 Bottom longerons
36 Top longerons
37 Central keel member
38 Stressed access panels along decking
39 Double-shock half centre-body
40 Boundary-layer bleed on 39
41 Space for boundary layer inboard of intake
42 Precision-cast intake lip
43 Drape-type fuel cell
44 Stressed floor to aft-fuselage tank bay
45 Pre-closing main-undercarriage doors
46 Liquid Spring unit
47 Door linkage
48 Main retraction jacks
49 Wheel-pivoting linkage
50 Wing carry-through frames
51 Wing pick-up points
52 Machined leading edge (R=0.016in)
53 Machined trailing edge
54 Wing root forged brackets
55 Continuous machined skin, root to tip
56 Hinged leading edge
57 Plain flap with blowing
58 Bleed air duct for flap-blowing
59 Leading-edge actuator
60 Flap actuator
61 Grouped aileron actuators (10)

Lockheed F-104A Starfighter

One General Electric J79-GE-3 turbojet with afterburner. Basic data: Span, 21ft 11in; length, 54ft 9in; height, 13ft 6in; tailplane span, 11ft 11in; wheelbase, 15ft 1in; track, 8ft 9in; gross weight, approximately 15,000 lb here or 20,000 lb with maximum external stores; maximum speed, about 1,500 m.p.h. (Mach 2.27); ceiling, over 90,000ft; extreme range, over 1,200 miles; landing distance over 50ft, approximately 3,000ft.



43 Stores pylon
63 Tip tank (200 U.S. gal)
64 GAR-8 (Sidewinder) air-to-air missile
65 Infra-red seeker head
66 Control servo section
67 Norris-Thermador or Hunter Douglas motor tube
68 Tracking flares
69 Pod containing T.171-E3 gun
70 Linkless ammunition feed
71 Tank holding 750 rounds
72 Generator access panel
73 Generators (Red Bank division of Bendix)
74 Generator cooling-air feed
75 Chemically milled duct (see "Aircraft Production," April 1958)
76 Inner wall of starboard duct
77 Low-speed auxiliary intake doors
78 Hamilton Standard pneumatic starter (60 h.p.)
79 Variable-stator actuator
80 Hydraulic group on engine-bay door
81 Filters
82 Accumulators
83 Charging points
84 Forward portion of ventral fin
85 Air brake ram
86 Fuselage break-joint
87 Attachment-bolt access flaps
88 Engine mounting
89 Afterburner fuel gallery
90 Navigation light
91 Braking parachute door
92 Afterburner
93 Hydraulic nozzle actuators
94 Ejector air duct
95 Tailplane actuator group
96 Tailplane horn
97 Tailplane hinge
98 Single skin, tip to tip
99 Autostabilizer tab
100 Air-conditioning bay

The very neat main undercarriage (left) utilizes Liquid Spring shock struts of the type pioneered by Dowty Equipment, Ltd.; the units are produced by the Cleveland Pneumatic Tool Co. On the right is a close-up of the port intake, showing the centre body and bleed ducts.

F-104 . . .

the 104 is of necessity associated with a sophisticated intake and exhaust system which enable its full potentialities to be realized at such speeds. The intakes, one of which is depicted in a photograph (above, right) comprise lateral scoops provided with a central shock-forming ramp and two boundary-layer bleed ducts. Pressure recovery is claimed to be almost equivalent to the ideal attainable with an infinity of weak shocks. The ducts are formed from thick light-alloy slabs which are chemically milled to an integrally stiffened form and then stress-relieved by stretching to the required profile.

Equal importance attaches to the propelling nozzle. In view of the fact that flight Mach number, mass flow, ambient pressure, density and temperature and degree of afterburning can all vary over an exceptional range, the nozzle is of an advanced design with multiple segments giving considerable area variation. These segments are operated by four Aeroproducts high-temperature hydraulic actuators. They are associated with an aerodynamic means for varying nozzle profile, effected by a secondary flow between the jet-pipe and the nozzle segments and a further flow between the nozzle segments and the structure of the rear fuselage.

Fuel is housed in almost every part of the fuselage aft of the cockpit that is not already occupied by the main undercarriage or powerplant. Much the largest single cell is a drape-type tank made by Firestone in two-ply nylon impregnated with Buna-N rubber, which is shaped to occupy the spaces between the fuselage frames and thus have the maximum possible capacity. Tanks can be carried under the wings and on the wing tips, much effort being necessary before satisfactory jettisoning was achieved.

The cockpit is relatively conventional, apart from the unusual —and possibly controversial—choice of a downward-ejecting seat. Most F-104s currently in service have a simple seat somewhat similar to those used in B-47s and 52s.

Later machines will have a new design of seat offering more complete supersonic protection, provided with stabilizing fins and a flat-plate skip-flow generator carried on a long pole ahead of the seat proper and intended to reduce the Mach number of the flow around the occupant to a subsonic value. Entry to the cockpit is gained via the simple side-hinged canopy, which is a Swedlow product with high optical qualities, sealed by a Goodrich inflatable strip with a ribbed striker bead. Hamilton Standard supply the air-conditioning unit.

All F-104s so far built for the U.S.A.F. have built-in armament in the form of a single General Electric T.171 six-barrel revolver gun (the Vulcan "Gatling" gun), which is mounted on the port side of the forward fuselage. It is fed with ammunition from tanks behind the pilot's seat and is driven by either an electric or hydraulic motor. Maximum rate of fire of this 20 mm weapon is 6,000 rounds per minute. Additional T.171s can be carried in underwing pods, as the cut-away drawing shows. Secondary armament comprises GAR-8 Sidewinder air-to-air missiles, carried on the wing tips. The F-104 is also reported to be currently engaged in tests with the MB-1 Genie nuclear air-to-air rocket.

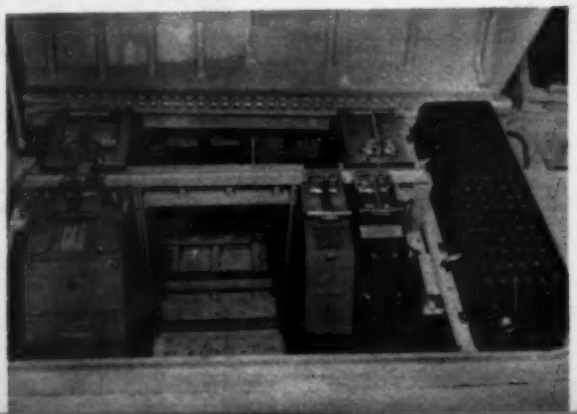
In offensive rôles the aircraft can carry up to five stores, two on the wing tips, two on the underwing pylons and one on the centreline ahead of the main-wheel doors. At least one, and probably three, of these locations can accept tactical nuclear weapons, although no 104 has yet been reported to be equipped for automatic toss-bombing.

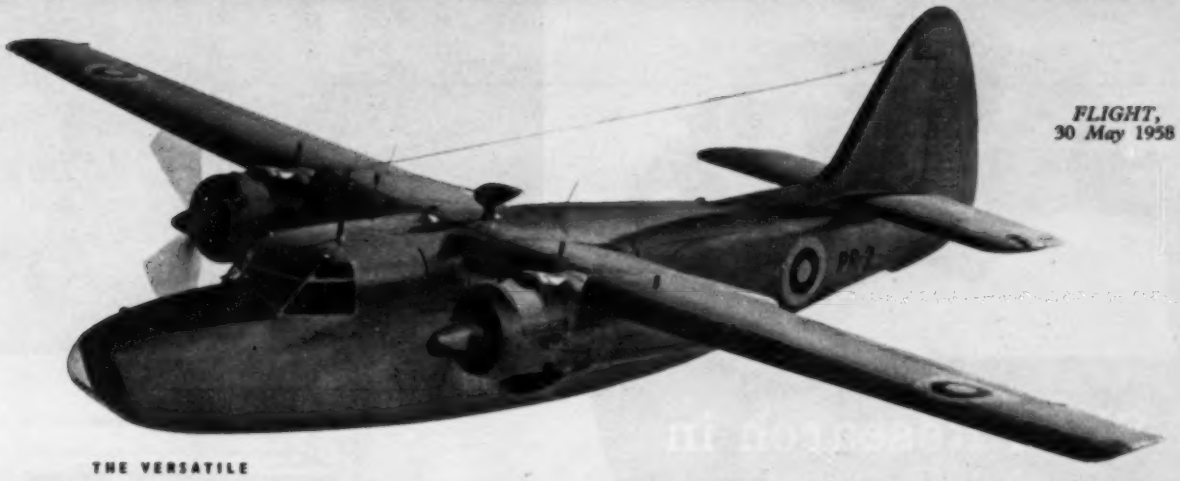
Assembly of the production 104 was initially assigned solely to the main plant of the Lockheed California Division at Burbank; and, following a practice common among major U.S.A.F. aircraft programmes, manufacture of 40 per cent of the airframe was allocated to a number of sub-contractors. Chief of these are Beech (Wichita), rear fuselage; Goodyear (Litchfield Park), nose; Rheem (Downey), complete tail unit; and Temco (Dallas), port and starboard wings. Lockheed manufacture the mid and forward fuselage sections at both Burbank and their new facility at Palmdale, and the latter plant is now handling all the assembly and flight testing. It is worth noting that each portion is delivered to Palmdale complete and functionally tested, so that assembly involves little more than making the mechanical connections and coupling up the pipes and cables.

Bulk production began late in 1956. Originally many hundreds of F-104A single-seat fighters were ordered for Tactical Air Command, and output was planned accordingly. But at the end of last year the reduction in the overall size of the U.S.A.F. from 137 wings was felt most keenly by T.A.C., whose air-superiority strength (composed of F-104A squadrons) was cut to what was

Powerplant of the F-104 in all production versions is the General Electric J79 (left). This is a single-shaft, variable-stator engine, with an afterburner which raises the sea-level static thrust from about 10,900 lb to a maximum value of about 15,000 lb.

Below is a view looking into the electronics bay. The packaged units are readily removable and can be arranged to suit various missions.





THE VERSATILE

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(Powered by Alvis 'Leonides' engines)

Now in service with the Air Forces of seven nations, the PEMBROKE is rugged, dependable and versatile. The PEMBROKE is particularly suitable for the transport of senior staff officers, in which role it is equipped to carry six passengers. The standard communications aircraft carries up to twelve passengers in either forward or rearward facing seats which are quickly removable for conversion to the freighting, photographic, ambulance or supply dropping roles. Pilot training, and aircrew training for which the aircraft is equipped as a flying classroom, complete the varied roles in which the PEMBROKE can be operated. Provision is made for all these roles in the basic structure.

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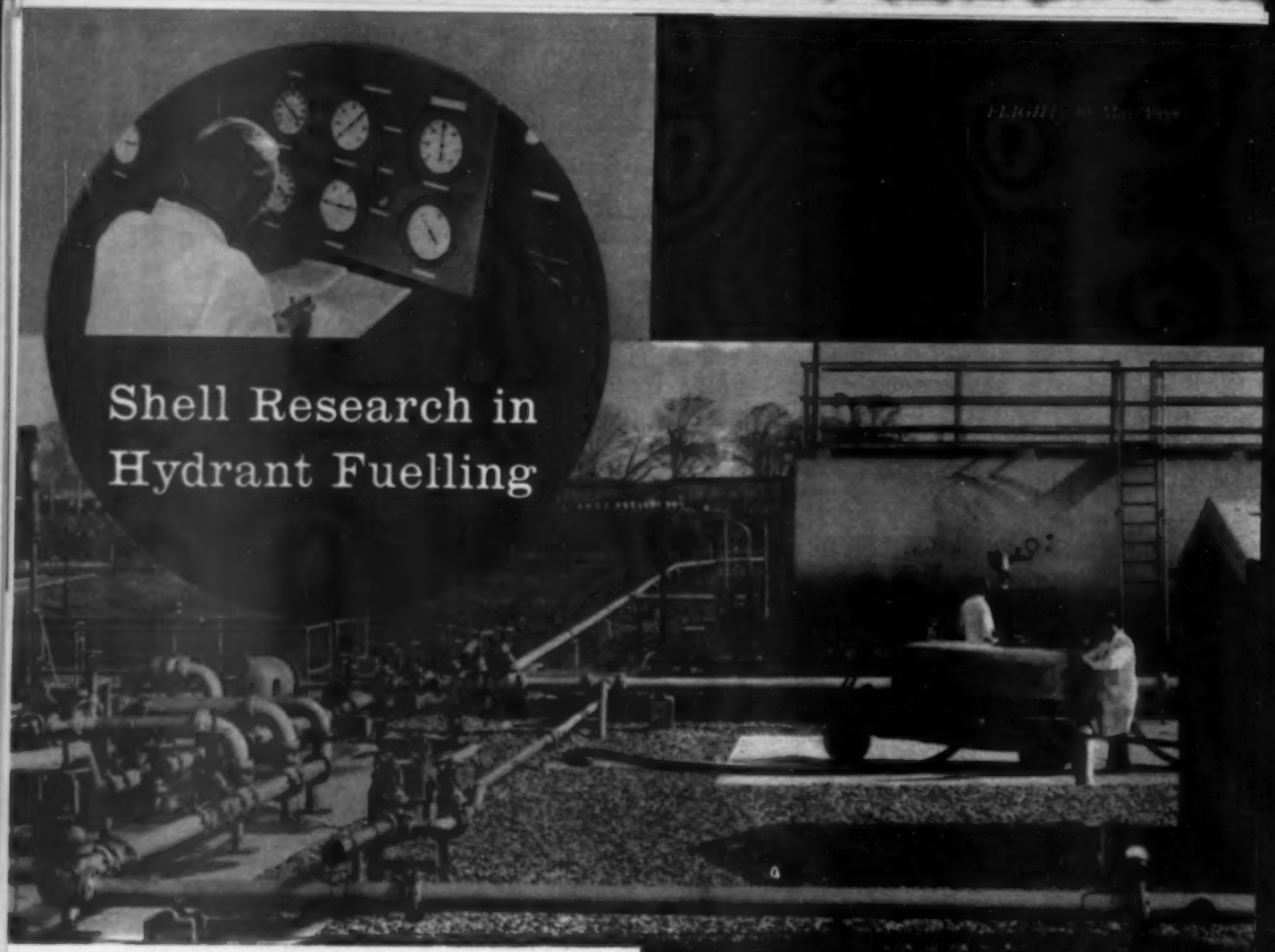
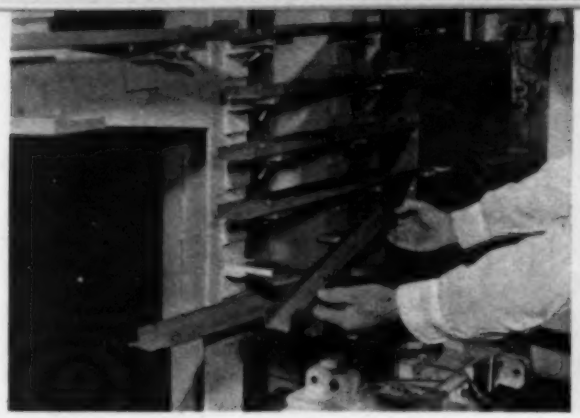


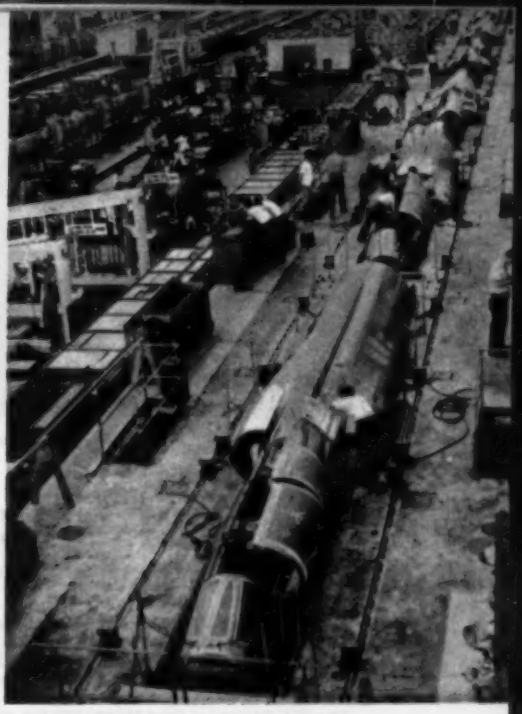
Shell Research in Hydrant Fuelling

Shell Research
in the Service of Aviation

Fuelling the airlines of the world is our business and the provision of the most up-to-date, efficient and economical methods of delivering fuel to aircraft is our constant concern. At the Shell Research Centre at Thornton, a full-scale experimental hydrant fuelling system is established on which are tested all the varied components of an airfield hydrant system – pumps, shock alleviators, sensing instruments, filters, automatic pressure valves, unions, couplings, hose equipment. Over 100 hydrant systems are already in operation by Shell Aviation Service throughout the world and nearly as many more are planned or under construction at airfields where they offer economic and operational advantages to the airlines.



The photograph on the left gives an indication of the diminutive size of the wing. Compression-formed 75ST spars are being set up in the main wing jig, each spar covering half the semi-span.



On the right is the fuselage line in the main plant at Burbank. From here the major sections of each machine are trucked to Palmdale for final assembly. Output is working at less than capacity.

F-104...

cryptically described as "not very many wings." As a result the total U.S.A.F. order was pruned to the relatively trivial total of 294 aircraft, and the majority of these have now been built. The result is that big surplus productive capacity exists, and Lockheed are in the fortunate position of being able to offer the aircraft at a very competitive price, all tooling costs having been written off on the existing orders. The mean price per aircraft paid by the U.S.A.F. is reported to be $1,112,000; but the 104 is stated to be available, almost "off the shelf," at $678,000. This is the figure alleged to have been quoted to the West German government, and it is one which no other manufacturer of a similar product could hope to match.

In the development of the F-104 Lockheed, G.E. and the U.S.A.F. had to face and overcome many very severe problems. Their solution took longer than had been hoped, and squadrons of 104As were not formed until this year. The first deliveries were made to the 83rd Fighter/Intercepter Wing, based at Hamilton A.F.B., near San Francisco, late in February. It is appropriate to list some of the major development programmes which were completed before this release to the user could take place.

Lockheed's original contract, for two XF-104s, was placed in March 1953. The first of these flew on February 7, 1954. From the XF-104 was evolved the F-104A, the chief differences being an increase in fuselage length to accommodate more fuel, a change in engine from the Wright J65 (Sapphire) to the J79, and minor alterations including a redesigned rear fuse'age, a nose undercarriage arranged to retract forwards (XF-104 hinged to the rear) and supersonic intakes. The first F-104A flew on February 17, 1956.

One of the most fundamental and protracted programmes was that which cured the super-stalled pitch-up. This cure, already described, was completed by April last year. Extensive flying at the boundaries of the 104's performance showed that no part of the load-carrying structure could reach a temperature above 200 deg F solely as a result of kinetic heating, and that the 0.016in-radius leading edges of the wing and tail did not erode drastically even in heavy rain or hail. For a considerable period the tip tanks tended to fly in and hit the fuselage after jettisoning, and much work was also necessary to prove the aircraft for gun-firing, GAR-8 firing and stores-dropping. Last winter a machine flying from Eglin A.F.B. showed its range by flying to a target more than 600 miles distant, dropping a simulated nuclear store at maximum speed, flying back and landing with more than 500 lb of fuel remaining.

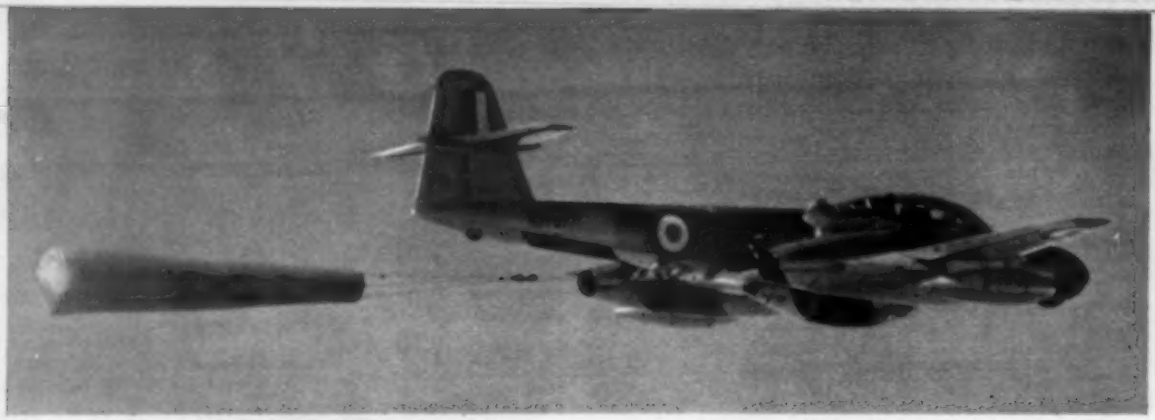
Squadron pilots seem to have found little difficulty in converting to the type. No simulator is needed, neither does any F-104 squadron yet have the services of a two-seat F-104B. The latter, which is in full production alongside the A model, is fully equipped for operational missions and differs chiefly from the single-seater in having a cockpit which extends back into bays formerly occupied by fuel. Like all recent fighters the 104 is intended for all-weather operation. The ASC-14 radar fire-control system, produced jointly by G.E. (LMEED), Aerojet-General and R.C.A., is packaged into neat sectors which plug-in around the circular space, some 30in in diameter, in the extreme nose of the aircraft. Pilots have found that, in practice, intensive lock-on training is required if targets are to be held, but their task is eased by the fact that the 104 is an outstandingly good gun-platform.

Most of the really dangerous development flying, in which several aircraft were lost, stemmed from difficulties with the powerplant. This in no way reflects upon G.E., since the J79 was even less of a known quantity than the aircraft when F-104A flying started. It is, however, singularly unfortunate that a major engine snag should have been suffered just after the release of the aircraft to the Air Force. Early in April the U.S.A.F. grounded all 104s fitted with the J79-GE-3A, except for machines engaged in current engine development. Notwithstanding the fact that the J79 as a type had then run some 44,000 hr, it was found that "pure engine trouble" (we quote the U.S.A.F.) was the cause of a series of accidents, in one of which the commander of the 83rd F/I squadron was killed. Roughness, backfiring and flameout in the afterburner was vouchsafed as a particular headache.

Nevertheless, it is fair to regard the basic F-104A as a fully proven weapon system. It is now in service with a number of F/I squadrons, together with all its specially designed support equipment (which, for the benefit of British readers, is regarded as the non-flying portion of the weapon system). Every conceivable type of operational problem has been evaluated and, where possible, simulated; and the proving has extended to such simple, but cumulatively important, items as the number of steps the ground-crew chief needs while walking from the starboard intake to remove the cover over the pitot tube in the nose.

Future developments concern such programmes as zero-length launching with rocket-boost, the dropping of real nuclear stores by various delivery methods, the firing of MB-1s, and the introduction of F-104s fitted with the more powerful GE-7 version of the J79 which has a turbine of 2in greater diameter. There may yet be a pilotless version—a sort of thousand-mile Bomarc—but no requirement for such a device has yet been stated by the U.S.A.F.

The photograph below was taken on May 16 at Edwards A.F.B., when Capt. Walter W. Irwin took off on the flight which promises to bring to him the world record for absolute speed. His average speed for the two runs was 1,404.19 m.p.h. The runs were made at 40,000ft in an o.a.t. of −60 deg. C. Even this temperature was too warm, he said, and on other occasions he has exceeded 1,500 m.p.h.



A Meteor TT.20 streaming a sleeve target from beneath the rear fuselage. The winch is above the starboard inner wing.

Jet Tugs for the Royal Navy

ARMSTRONG WHITWORTH MODIFICATION OF THE METEOR NF.11

THE Meteor TT.20 seen above has been developed by Armstrong Whitworth from their NF.11 night fighter, to satisfy the requirements of the Royal Navy for a high-speed target-towing aircraft for shore-based ground-to-air gunnery practice at home or overseas.

The TT.20 carries four 3ft by 15ft (or 4ft by 20ft) high-speed, radar-responsive sleeve targets, stowed in the rear fuselage and launched while the aircraft is airborne. An M.L. Aviation windmill winch, mounted on a pylon over the starboard inner wing, is used for paying out or hauling in the 6,100ft towing cable. Near-miss recording gear, together with conductive cable and target microphone, are carried in the targets. Hits and near misses are signalled via the towing cable to an indicator on the control panel in the rear cockpit.

The towing cable is routed from the rear of the winch to a pulley at the trailing edge of the wing, through a tubular strut to a pulley beneath the fuselage, and thence through a cable cutter and buffer unit to the exchange/release unit. The four targets are contained in cylindrical canisters with a D-section mouth projecting at the lower end through the fuselage skin. Each folded target is held in its canister between a trap-door in the mouth of the canister and a Tufnol disc attached to the sides of the canister by elastic cord. A solenoid-operated trip mechanism holds the trap-door in the "up" position. When released the door opens downwards, and ejection of the target is assisted by the elastic cord. Ejection is notified on the control panel by indicator lights operated by microswitches.

The exchange unit allows successive targets to be released and new ones substituted in the air. There are two pairs of retracting pawls in the exchange unit, each pair, in the emerged position, forming an abutment for the jockey ring of the target bridle. When the exchange unit is wound right up to the buffer the forward pawls are out and the rear pawls retracted. The jockey ring of a launched target is pulled rearwards and comes to rest against the forward pawls. As the cable is paid out the rear pawls emerge and the forward pawls retract: the rear pawls then become the towing stops. When the cable is subsequently wound until the exchange unit compresses the buffer, the rear pawls retract and the used target falls to earth. At the same time the forward pawls have emerged ready to receive the next jockey ring. Flight trials of a new type of exchange unit, which will allow the operation to be carried out in about two minutes instead of the present 12 to 15 minutes, are imminent.

Fitted immediately forward of the buffer is the cable cutter. Its principal parts are a cocked, spring-loaded cutting blade and an anvil, between which the towing cable is routed. The blade-trip mechanism is remotely controlled, an operating handle being provided in both front and rear cockpits. The blade is reset, after a cut has been made, by means of a cocking key located in the rear cockpit.

Some re-routing of the rudder and elevator control cables round the target canisters has been necessary and additional equipment is installed in the two cockpits. The four-gun armament has been removed. Deletion of this and other items such as tropical kit, water bottles, rations and signalling equipment allows the operation of the TT.20 at comparable weights to the standard NF.11 aircraft, and hence similar airfield capabilities obtain. Performance and general flight characteristics with target stowed are not greatly affected.

Further systems, designed to allow an increase in both speed and endurance, are now under way; and trials should be completed by the end of the summer.

The Meteor TT.20 will make it possible for Naval anti-aircraft gunners to practise with a relatively fast target, providing an accurate assessment of hits and near misses. Several targets can be streamed during each sortie and each target can be retrieved.

X-15: EXPLORER OF THE OUTER ATMOSPHERE

REPRODUCED here is a manufacturer's artist's impression of the North American X-15 rocket-powered research aircraft. This new official view clearly shows the pronounced wedge section of the vertical control surfaces, the lower of which is jettisoned before landing.

The cylindrical section of the centre fuselage forms a series of integral fuel tanks, the control runs and other equipment being located in the lateral fairings. To mitigate the effects of kinetic heating all hydraulic pipe joints are brazed, to avoid trouble which might occur with conventional screwed unions. Propulsion is by a single-chamber Reaction Motors unit giving 60,000 lb thrust for about three minutes.

Since the X-15 will operate for some of its flight time outside normal atmospheric conditions, a stellar-inertial system will serve both for navigation and for operating flight instruments. Small "cold" rockets at nose and wing-tips will maintain the X-15 in an attitude suitable for re-entry into the atmosphere after a ballistic sortie into space. A capsule escape system is fitted and the pilot will wear a special full-pressure suit made of silver material designed to reflect heat.

Pilots of the X-15 will be Scott Crossfield, Capt. Iven Kincheloe and Joseph Walker.

Line-up of competing gliders at the R.A.F.G.S.A. championships at South Cerney last week, with a T.21B Sedbergh coming in to land.

CLUB AND GLIDING NEWS

GENERAL agreement with the opinion that a "Golden Age" was a personal state of mind, usually coinciding with the youth of the individual concerned, was evident at the Kronfeld Club on May 21 during a debate "That the Golden Age of Gliding has now passed." More-precise definitions of the golden age of gliding were given by the two proposers of the motion, Peter Fletcher of Dunstable (who said 1937-39) and Wally Kahn of Lasham (who said 1910-30). For the opposition, an eloquent Lionel Alexander of Cambridge pointed out some of the disadvantages of the old days, and C.F.I. John Ellis of Oxford seconded.

Floor speakers put forward various contrasting estimates and opinions. To many the age under discussion had not yet arrived, and designer F. N. Slingsby disclosed that, as a manufacturer, he had been chasing the golden age for 28 years and had not yet caught up with it. Other views concerned the unrestricted intake of gliding pupils; the lack of advanced-soaring training; and the relative merits of contest flying with an objective and of just "flying for fun." The final vote, chairman Dudley Hiscox announced, showed a large majority against the motion. By way of emphasis, a telephone call was received at that moment giving news of Sgt. Gough's eminently golden-age-worthy flight to Holland.

THE general report of the Kuala Lumpur Flying Club for 1957 includes the admirable news that, "On the social side, the house sub-committee have raised the curry lunches on Sundays to a standard unequalled in Kuala Lumpur; the club at times being filled to capacity and the demand for curry straining catering to the limit." On the flying side, a new Tiger Moth and a Chipmunk had been added to the fleet, and there had been a number of changes in the instructional staff during the year. Flying hours for 1957 totalled 1,050—the highest figure for the last three years. Among the flying events of the year had been the club's participation in the Malayan Air Rally at Kluang in July. A number of bursaries are to be awarded by the club to enab'e young Malayan citizens to learn to fly up to P.P.L. standard at subsidized rates.

AEROBATIC participation at the Exeter Aero Club air display on June 28 will include the 56 Sqn. Hunter team and a Jet Provost formation from the Central Flying School. The Fleet Air Arm and the U.S.A.F. will be represented, in addition to other R.A.F. units. An inter-club spot-landing competition for members of the Exeter and Plymouth Aero Clubs will take place on July 12, and other events at Exeter during July will include the competitions for the Parkhouse Navigation Trophy and the Bennett Airmanship Trophy.

HIGHLIGHT of the R.A.F. Gliding and Soaring Association championships at South Cerney, near Cirencester (May 17-26), was the outstanding flight on May 21 by Sgt. Andrew Gough in a Slingsby Skylark 3 to Heerlen in south-east Holland, a distance of 346 miles. This is the longest distance flown in a sailplane from the United Kingdom. Gough, representing the R.A.F. Wessex Club, Andover, released from a Chipmunk aerotow launch at 11.15 a.m. and was observed over Folkestone at 2 p.m. prior to crossing the Channel. His landing was made near the Dutch/German border and some eight miles short of R.A.F. Geilenkirchen at about 7.25 p.m. Pilot and sailplane were flown back to this country in a Valetta on May 23.

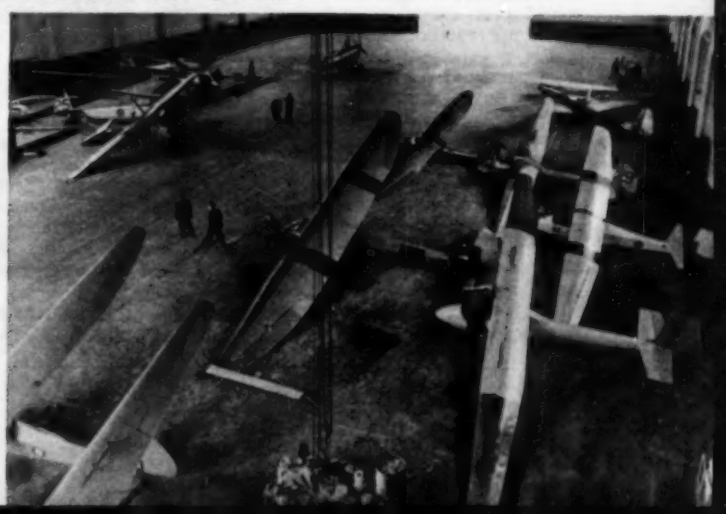
Sgt. Andrew Gough of the R.A.F. Wessex Club, who set up a new British distance record on May 21 by flying the R.A.F.G.S.A. Skylark 3 from South Cerney to Heerlen in the Netherlands, a distance of 346 miles.

"FLIGHT" photographs

A MIDSUMMER air display will be organized by the North London Aero Club at Panshanger on Saturday, June 21. Parachuting, gliding and Tiger Club aerobatics are included on the programme. Membership of the North London club continues to rise: two additional instructors are being engaged, and the aircraft fleet now comprises two Tiger Moths, three Taylorcrafts and one Autocrat.

WINNER of the Dr. Mervyn Hall Memorial Flying Scholarship for aborigines, founded by the Aircraft Owners and Pilots Association of Australia, is William Bennell, aged 19, of Perth. Having passed medical and flying-aptitude tests in Perth, he is now undergoing flying training at Bankstown Airport.

Among the officials and visitors at the South Cerney R.A.F. Gliding Championships were (upper row) A. Cdre. G. J. C. Paul; Air Marshal Sir Raymond Hart, R.A.F.G.S.A. president; G/C. R. R. Goodbody, chairman; G/C. G. F. Lerwill, C.O. of South Cerney; and (lower row) F/L. R. C. Salmon, assistant controller; S/L. R. B. Stratton, operations controller; F/L. J. A. G. Ross, tugmaster; Mrs. M. Sharman, timekeeper; and F/L. B. B. Sharman, launchmaster. Below right, a hangar view of some of the competing aircraft.



Straight and Level

DID you notice the rugged stockman (gaucho?) on British Messier's front cover advertisement of *Flight*'s Flying Aids special issue of May 16? I am comforted by the thought that though he has never heard of pitch-stabilized Dopplers or glide-path and azimuth guidance, he is indirectly a customer, without whom we would starve to death. We can't *eat* flying aids.

● Who says British club pilots have a tough time these days? You boys don't know how lucky you are. Take Poland, for instance. According to recent reports, government authorities there are beginning to look askance at the "turbulent" development of sporting flying. They feel that "reactionaries" might dominate the clubs. The answer? "Our task, therefore is to create in the aero clubs a real basis for political work by the setting up of Party groups."

Things aren't really too bad over there, however. The Polish Aero Club has announced that "certain approved pilots will as from now be allowed to fly on cross-country trips within the country." And the future is even rosier: "If the planned air races and rallies abroad show promise, there may even come a time when Polish sports fliers will be allowed to fly abroad."

● Conversation between airline pilot and safety expert, on the subject of rearward-facing seats:—

Airline Pilot: "To say that it would be commercially difficult for airlines to fit rearward-facing seats is like saying, 'Let the airlines have more champagne and less de-icing fluid.' "

Safety Expert: "I always thought your airline's champagne *was* de-icing fluid."

I admired the safety expert's wit, but I deplored the context. It can never be stated too strongly that the issue of the rearward-facing seat is being shirked, and better technical judgment is being overruled by commercial interests.

I know it's all very difficult, and so easy to get emotional about. But couldn't we even try rearward-facing seats experimentally for a while? If one airline converted one of its aircraft, and said nothing, I'll wager that no passenger would ever complain, and that most would not even notice.

● Comment from a friend in the electronics business: "You know, there's nothing that can lock-on quite so well as the human eye." This made me wonder what the relationship might be between the movement of one's eyes when trying to see something at night and a radar scanner (of an a.-w. fighter, for example) operating in the search mode. This sort of topic has been the subject of research by the U.S.A.F., R.A.F., Royal Navy and several civilian scientific agencies.

● Last week I pointed out that many of the most important aeronautical "firsts" are insufficiently well known, and I am now rash enough to suggest what I believe are the correct dates.

(1) The first flight by a man-carrying, heavier-than-air machine cannot definitely be ascribed to any single pioneer or group. I feel, however, that by far the strongest claim is that made by the Wright Brothers, for December 17, 1903 (it was, incidentally, Orville who actually flew first). Mojaiski is insufficiently documented, and Maxim and Langley cannot really claim sustained, stable "free flight."

Having said that, I ask you to make what you will of the above memorial stone, which a puzzled *Flight* colleague photographed a few days ago at Hanover Airport. Translated, the inscription reads: "JATHO—The World's First Powered Flight, August 18, 1903."

(2) The first flight by a man-carrying aeroplane powered by jet reaction took place on September 30, 1929, near Frankfurt-am-Main. Fritz von Opel, the German car manufacturer, made a controlled flight of some 2,000 yd in a glider fitted with a series of solid-propellant rocket motors. The speed reached was some 85 m.p.h. (this is an eye-witness estimate) and the aircraft was wrecked upon landing. (Perhaps someone would like to take up the cudgels on behalf of the He 176 in July 1939.)

(3) The first flight by a turbine-driven aeroplane took place on August 24, 1939, when Capt. Erich Warsitz flew the Heinkel He 178. This aircraft was powered by an He S-3B turbojet of 1,100 lb thrust, and seems to have ended its days in the Berlin Air Museum (I would like to have confirmation of this). The date I have given, incidentally, was when the 178 first flew (a mere "hop"). The first real flight took place on August 27.

(4) The first man ever to fly faster than sound was Major Charles E. "Chuck" Yeager, United States Air Force. Flying the first Bell X-1, he was dropped from a B-29 mother ship on October 14, 1947, and accelerated to a true Mach number of 1.06. Later, the same aircraft reached its design limit speed of some 967 m.p.h. It now rests honourably in the Smithsonian Institution.

(5) The first to fly a helicopter was . . . well, let me quote Charles Gibbs-Smith (*A History of Flying*, page 239): "There are two contestants for 'first off the ground,' Paul Cornu and Jacques Bréguet. Priority just goes to the Bréguets because Cornu, although first off the ground, did not, it seems, rise vertically." Jacques Bréguet and his brother Louis (the great aircraft builder), assisted by Charles Richet, achieved hovering flight on September 29, 1907.

Well there they are: five dates of fundamental importance to aviation. And the curious thing is that only two of them—those for Warsitz and Yeager—can be quoted with absolute assurance; the others can all be contested. In fact I hope some of my readers do challenge some of them, because it is only thus that new facts are unearthed.

● Do you recall how exclusive were the "Mach-busters" and similar clubs for people who had flown faster than Mach 1? Today there are several thousand Mach-busters—all but a few hundred of them in the U.S.A. and U.S.S.R.—and Convair have now launched an M=2 club for all people who have flown at twice the speed of sound in a Convair-built aeroplane. There are two wings of this organization: the San Diego branch is headed by Dick Johnson, chief of engineering flight test on the F-106 series, and the Fort Worth wing is led by B. A. Erickson, manager of flying on the B-58.

It seems to me it won't be long before there are a lot of mayors' wives in California and Texas who will have flown faster than any pilot in the Old World.

● The other Monday I came into my office in a cheerful frame of mind, to find a chatty little news-agency picture-caption on my desk. According to Dr. Gerald P. Kuiper of the Yerkes Observatory of the University of Chicago, it said, the Sun will have become so large in three to four billion years' time that its total radiation will be 100 times stronger than it is now. The Earth's oceans will boil and fill the atmosphere with steam. All life as we know it will be destroyed. This phase should last about a billion years and then the Sun will shrink to a size much smaller than it is now. As the Earth's temperature drops, the whole planet will become a big ball of snow and ice.

Can the Minister make a statement?

ROGER BACON.

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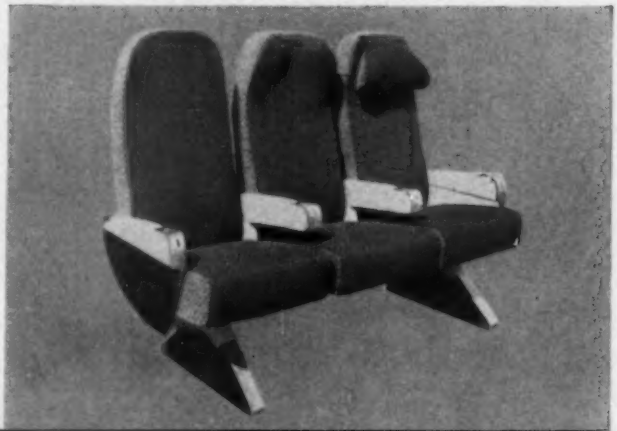

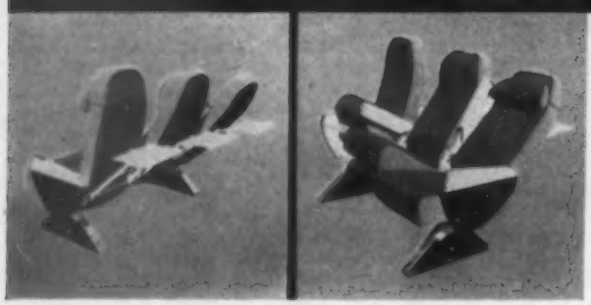

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AND HOME BY TRAIN

The Tale of a Ferrying Trip

By C. GAVIN-ROBINSON

Qantas Super Constellation passengers embarking for Sydney at Darwin's new terminal.

AT the end of December last year I was given the job of flying as co-pilot of a de Havilland Heron which was to be ferried from Christchurch, New Zealand, to Bahrain, on the Persian Gulf. This is the story of my round trip from London to Christchurch and back by means of (successively) Qantas, T.E.A.L., N.Z.N.A.C., Heron Series I G-APJS and lastly B.O.A.C.

The journey began on December 27 at Airways Terminal, Victoria, where I collected my ticket for Qantas flight No. 713 due to take off at 11 p.m. Determined to start us off well on our way to the other side of the world, the B.O.A.C. coach driver covered the distance from the Terminal to London Airport in 35 minutes flat, which must have beaten par for the course by some margin. We then had some time to wait at the airport, and I found a chair in that sort of limbo where lost or confused passengers wander near the B.O.A.C. ticket desk. Some of my future companions were nearby, and I noted with alarm that a woman was carrying a child of two. I am fond of children, but the very young often wail for long periods when confined in aeroplanes, and my fate is usually to be allotted a seat within uncomfortable earshot.

Eventually we were processed according to the law and conveyed by coach to the Super Constellation *Southern Wave*. In common, I believe, with the rest of the Qantas fleet of these aircraft, she was fitted with wing-tip fuel tanks, those impressive lumps of streamlining with a sinister little hole at the back which somehow make the Connie, normally just another great big aeroplane, look like something worthy of the space age.

At 2300 hr precisely the door was closed and the engines started. My seat was on the starboard side of the small after-cabin; and there, sure enough, just across the aisle and lying quietly in the arms of her mother, was the child. I will dispose of this particular infant by saying that despite apprehensions, and except for two squally patches, one near the Bay of Naples and the other over Turkey, she behaved remarkably well, feeding without fuss and sleeping peacefully in the special crib provided on board until she was removed from the aircraft at Singapore.

Life-jacket drill and the passing round of sweets completed the preliminaries, and we took off and climbed to 19,500ft, which was our height for the leg to Rome. After coffee and sandwiches the lights were turned down and we stretched out in our comfortable "slumberettes."

Before going to sleep I peeked through the curtains to see what the weather was doing and noticed how an ingenious use had been made of the tip tanks. On the inner side, visible to the passengers, the name QANTAS had been painted; and this was illuminated in red at intervals of about a second by the rotating beam of the collision beacon on top of the fuselage, the effect being similar to a flashing red neon sign making "QANTAS . . . QANTAS . . . QANTAS" all through the night.

There were thunderstorms over the Alps, and in spite of the storm-warning we hit a small patch of turbulence; the "ship went wop with a wiggle between" for a few minutes, and after that we were in the clear.

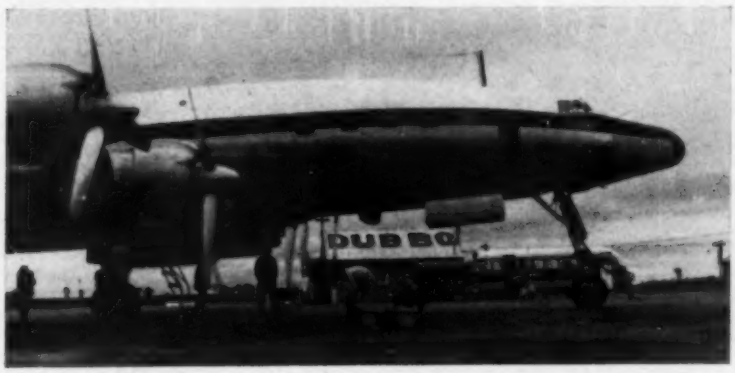
The crew was changed at Rome, where we had a drink and some biscuits, and the last of the night passed during the 3½ hours' leg to Istanbul, where we breakfasted on bacon and eggs. A large anticyclone was over Turkey, and in fact the whole trip from Istanbul over Ankara, Kirkuk and Baghdad to Bahrain was made in perfect weather. It was on this part of the route that the change in time became noticeable. Somewhere over Iraq lunch was served. Greenwich time was 1230 (on the 28th), which according to our tummies was the right time for the meal; but locally it was late in the afternoon, and in a further hour-and-a-half the sun set. Eating to English time was abandoned after this, dinner being served as early as 1645 between Bahrain and Karachi.

At Bahrain the rest of the ferry crew joined me. We took off for Karachi at 1615 G.M.T. and for the next twenty-four hours the trip was without incident. Karachi and Bombay were overflown at night, Colombo (Ratmalana) the following day and Singapore at night. At Singapore there is a descriptive little notice whereby those seeing off passengers are directed "To the Waving Gallery."

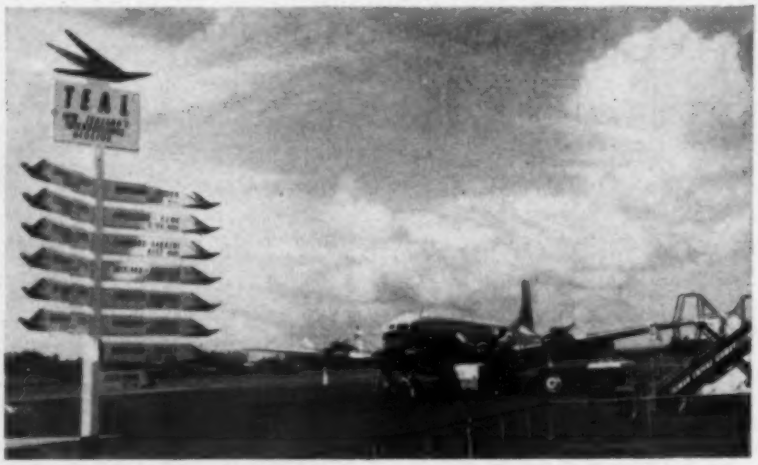
At 1750 G.M.T. on 29th we landed at Djakarta. Disembarking were two young accountants from London. They were new to the tropics—in fact, I think it was their first journey of any length abroad—and what with the stuffy humidity of the hot night, the reports of disturbances in Indonesia and the numerous steel-helmeted troops who patrolled the airport with Sten guns at the ready, they did not appear to be accepting their surroundings with much relish.

Our next stop was Darwin, which we reached soon after dawn. Frequent heavy rain showers were sweeping across the field, making things pretty dismal, but the smart new air-conditioned restaurant and a good breakfast redressed the balance and welcomed us to Australia. A joining passenger at Darwin was a cheerful elderly gentleman with both legs and one arm paralyzed; as he could not negotiate the steps his invalid chair was raised to door level by a fork-lift.

This was my first visit by air to Australia, and I was hoping to see something of the country during the flight to Sydney, which we made at 15,500ft; but for almost the entire route the ground was obscured by stratus cloud. Night fell before we reached Sydney,



Qantas Super Constellation "Southern Wave" at Dubbo on the morning after diversion from Sydney.



Tasman Empire Airways DC-6 at Auckland. The top fingers of the signpost show two different directions to London: westwards 12,620 miles, eastwards 14,078.

AND HOME BY TRAIN . . .

and the weather deteriorated. Heavy rain had been falling on Mascot Airport and had put the main instrument runway out of action through flooding, and the cloud on the other runway was below limits, so that when we arrived overhead the airport was closed. We flew in the holding pattern for over an hour while the crew, by means of the loudspeakers, kept us informed of the situation. Eventually the fuel was down to the minimum needed for diversion and we set course back over the Blue Mountains for Dubbo, a hundred and fifty miles to the west.

I am not familiar with Australian idiom, but I believe Dubbo can be described as an "outback" township. It is on flattish country, has a small river flowing through the outskirts and is laid out on either side of a long, wide main street. The airfield, about five miles away, has been made an approved diversion for Sydney by the construction of a runway capable of taking aircraft at least as large as the Super Constellation. The tarmac area is very small, and the terminal building just a large hut containing an operations room and other technical facilities.

We landed at Dubbo at 2215 local time on the 30th. A number of other diverted aircraft were already there, including a couple of Viscounts belonging (I believe) to A.N.A. and Butler. Accommodation had been arranged for us in the town's main hotel, a three-storey affair on the main street, to which we were conveyed by coach. It was a small hotel, clean and comfortable, but what impressed me was the hospitality of the staff; invaded by about 40 tired and hungry people at an hour close to midnight, they cheerfully prepared meals and kept the bar going long after the usual time. The crew of the aircraft, weary as they must have been, also did their best to make us comfortable.

Next morning we were taken back to the airfield at about nine o'clock to find that the refuelling tanker had run dry and had to go to the town to fill up. To bridge the delay a motor-coach tour of Dubbo was arranged, and most of the passengers went on it. We who remained strolled about the tarmac. After an interval the tanker came back and refuelling was resumed. This was completed and the aircraft made ready to depart. The only trouble was that the tourists were missing. We waited. The crew waited. Ten minutes later they still hadn't shown up, and those of us who had to catch onward connections at Sydney began to get a bit anxious. Then a phone call came through to say that the coach driver in his keenness to show the passengers everything that Dubbo had to offer had rounded off the tour with a visit to the cemetery and had there got the coach stuck in the mud! Some twenty minutes later the wanderers returned, having pushed the coach free after a prolonged struggle. Australian wit is trenchant, and its use on this occasion was without restraint; crew and passengers boarded the *Southern Wave* in a hilarious mood.

Another hitch came when we were all seated and the engines started: the tarmac was too narrow to turn the aircraft and the grass too soft for taxying. That the Connie should suffer the same fate as the coach was unthinkable, so the propellers were put into reverse pitch and the aircraft backed under its own power fifty yards to the runway.

I kept a log between London and Dubbo, and on the way to Sydney I totted up the number of meals we had had. I found that the total in an elapsed time of 61 hr 15 min, including meals on the ground, was nine main meals and ten snacks, which meant that we had been fed with something every three hours on an average, though the meals were so spaced as to allow long periods for sleep.

Thanks to the cemetery incident, we had just one hour at Sydney to clear Customs and re-embark on a T.E.A.L. DC-6 for Auckland. Thanks to the efficiency of all concerned this was accomplished without hurry or fuss. R.M.A. *Aotearoa III* was as clean inside and out as any aircraft I have ever seen. An excellent dinner was served aboard, and in spite of having to fly through the bad weather which had affected Sydney the previous night, the whole 4½ hours' trip, flown at 19,000ft, was most comfortable. I also liked the magazine flight-companion given to each passenger and containing much useful information about the airline, illustrated articles and stories, and even crossword puzzles.

Helpful as they were, T.E.A.L. had been unable to find us even a sofa to sleep on in Auckland that night, it being New Year's Eve and the whole town packed. However, an appeal to the R.N.Z.A.F. brought a warm invitation to spend the night. Returning to the airport by taxi, we reached the officers' mess at two minutes to midnight, just in time to toast the New Year in good New Zealand beer.

New Zealand is a country of exceptional beauty. Snow-topped mountains mingle with hills and lowland covered in forests and greenery where flowers of all kinds grow in profusion. Very little of the country is flat or regular, and this quality, though pleasing to the eye, does not favour aviation. Westerly winds, sweeping unchecked across the Tasman Sea, break into violent eddies when they strike the mountains, and aircraft flying in the lee, particularly in the alpine South Island, have a rough time. The nature of the country also means that aerodromes have to be built where possible and not necessarily where convenient. Thus the citizens of Auckland must travel sixteen miles to their airport of Whenuapai, and those of Wellington twice as far to Paraparaumu. A carefully planned airways system covers the country, well equipped with radio aids, so that N.A.C. and other users can operate safely in any weather.

On the first day of 1958 we continued our journey to Wellington in a Dakota of N.Z.N.A.C. (New Zealand National Airways Corporation) named R.M.A. *Powhaitere*. There was no cabin service on the aircraft and smoking was not permitted, this being normal on short internal flights; in other respects it was an excellent trip with efficient handling at both ends. As with T.E.A.L., passengers were given something interesting to read during flight; in this case it consisted of the *Airline Review*, house journal of N.A.C. In it I found an article which, contributed by a passenger, showed well the close relationship between the New Zealander and the airline

The Heron being handed over at New Zealand National Airways Corporation's maintenance base at Harewood, Christchurch. Fourth from the left is Capt. W. Pallett of Gulf Aviation.

Refuelling the Heron at Alice Springs. At left is a Cessna.

serving him. It contained these curiously refreshing words:—

"I count myself fortunate in living under an air route. It is an interesting position as the planes, after a time, assume an individuality of their own. There is one which flies over the garden on Saturday morning and allows me to ease my aching back as I lean on the spade to watch it. There is one which puts an inch to my stride in the morning when I can see from its position that I'm running late. Even when I'm sitting in front of the fire on a blustery night with a north-westerly blowing hard outside, there is one which never fails to arouse my admiration as it roars home to Paraparauma in its long struggle from the South against the wind. Sometimes the clouds fly low, but it doesn't matter, the engine throb drifts down and lets me know the daily tryst is kept."

A week later we collected the Heron from N.A.C.'s new and magnificent maintenance base at Harewood, Christchurch, and after a stop at Wellington positioned at Auckland for the crossing of the Tasman Sea. G-APJS was equipped with a 100-gallon fuel tank in the cabin, giving a total endurance of about nine hours at 140 knots. Dual controls and blind-flying panels were fitted, a feature which eased considerably the long flying days of the ferry trip. The radio operator occupied a forward passenger seat where a Marconi H.F./M.F./R/T. and W/T. set had been installed on a tubular stand.

Before leaving Auckland we changed a magneto on No. 3 engine. Apart from routine greasing of the propeller hubs, the only time the Gipsy Queen 30 Mk 2 engines were touched during the whole flight to Bahrain was at Singapore, where the contact-breaker points on the same magneto were adjusted to reduce a small drop in r.p.m.

Our destination in Australia was Sydney, and even with the long-range tank the prevailing westerly winds made doubtful the outcome of a direct flight. Accordingly we made an intermediate landing at Norfolk Island. Unfortunately an active front was smothering the island in low cloud and rain, so all we saw of it was luxuriant vegetation, towering trees—Norfolk pines—and the slope of a green forested hill disappearing up into veils of mist and cloud. The main runway, which has a hard natural surface, partly grass-grown and on this occasion dotted with pools of water, is 300ft above sea level, starting almost at cliff-edge and cutting its way inland through heavy vegetation towards rising ground. Norfolk Island has a population of 800, most of whom are agriculturists, the climate and soil being such that "anything will grow." We refuelled as quickly as the heavy rain would allow, and after a brief farm-house meal took off for Sydney. Five minutes from Norfolk Island we emerged into clear weather, and passing over the beacon on Lord Howe Island at the halfway point, reached Sydney in the late afternoon.

At Sydney we spent some days arranging clearance through Indonesia and then set off for Darwin. Apart from the direct route flown by long-range aircraft, there are two ways of crossing Australia, both well supplied with radio aids. The northern route is by Longreach and Cloncurry, but we chose the slightly longer southern one through Broken Hill and Alice Springs.

Except for the coastal area around Sydney, and widely scattered patches of fertility mostly where hills break the surface of the plain, our route across Australia can best be described as over a red earth wilderness dotted with isolated homesteads. Broken Hill is a small township with a good aerodrome surrounded by hundreds of miles of such country. Here, in the hangar, we saw a Drover of the famous Royal Flying Doctor service. Alice Springs, at approximately the geographical centre of the sub-continent, lies in the flat valley between two long ridges. Because of its situation plenty of trees and other vegetation surround Alice, though the grass is of the quick-growing kind which shoots up after rain and disappears during drought, giving place to red dust. We spent a night there in the rather grim new hotel, where we were most hospitably received. The following day we flew direct to Darwin.

Next morning we arose at 3 o'clock in the dark, ready to fly through Indonesia to Singapore without further rest. While we were flight-planning for Koepang a Britannia arrived, also westbound. Then a violent thunderstorm came in from the sea accompanied by heavy rain, and both crews decided to postpone take-off until it was over. When the rain stopped the Britannia took off first, and we followed twenty minutes later. There was another large storm over the sea, giving a most spectacular and discouraging display of lightning; but as we were preparing for a take-off for which our enthusiasm was fast diminishing a message from the Britannia announced that she was climbing on a heading of 330 deg to avoid the storm. Grateful for this sharing of her storm-warning radar, we set the same course, and although while darkness lasted the lightning was almost blinding, we had a smooth flight clear of cloud.

Acting on advice that no fuel was available at Koepang, we had loaded the Heron with 100 gallons in four-gallon cans. We landed on the old wartime runway in the early morning sunshine, wondering what our reception in Indonesia would be. However, everyone at Koepang was most friendly, and a large number of volunteers as well as the local Shell staff came to help refuel us out of the cans. We were away in an hour for Sourabaya.

The intertropical front was lying along the islands of Indonesia, not particularly active but marked by scattered thunderstorms over and near the land. At our height of 6,500ft there was no difficulty in keeping out of trouble and the Heron hardly touched a cloud the whole way to Singapore.

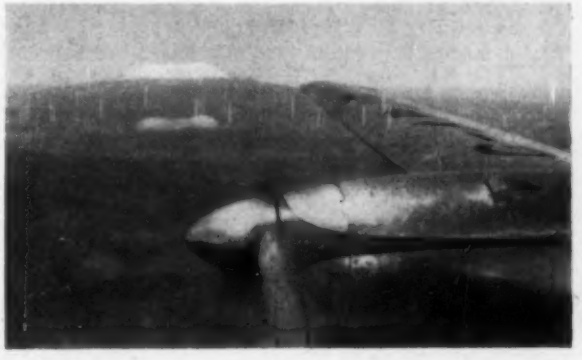
After refuelling in forty minutes at Sourabaya we reached Djakarta in the late evening, where formalities were hampered by the simultaneous arrival on a State visit of the Prime Minister of Czechoslovakia in an Indian Airlines DC-4. We left Djakarta as darkness was falling and reached Singapore a trifle weary, at 10 p.m.

Two days later, on January 26, we took off for Bangkok. Just after we had left the ground the Singapore controller, who must have been right on the ball, called over the R/T, "Your undercarriage appears to be still down"; to which pilot Bill Pallett, throwing the line away, mildly replied "It's *permanently* down."

We reached Rangoon at sunset, night-stopped and, after a second long day's flying with landings at Calcutta and Delhi, reached Karachi late at night.

The next day, after a leisurely departure, the last leg of the ferry flight to Bahrain was covered in perfect weather made even better by a spanking tail-wind which over the first half of the route chased the Heron along at 155 knots. Approaching Bahrain we encountered a curious phenomenon. Local time was about 4 p.m. with the sun lowering to the west ahead of us. Bahrain was reporting no cloud and a visibility of eight miles, yet the island ten miles away was invisible below a very thin layer of pearly haze as though a sheet of opaque Cellophane had been stretched above it. From the ground the haze could not be detected.

With the arrival of the Heron in Bahrain my job was done and home was calling. Accordingly, the next day I boarded the B.O.A.C. Constellation "terminator" bound for Beirut, Rome and London. Because of the prospect of fog we spent the night in Rome, but even this plan to outwit the English weather did not succeed and the aircraft was diverted to Hurn. Here facilities had to be shared with several other large aircraft in a similar predicament, and coping with everything was a solitary girl traffic officer who fought the confusion with charm, patience and efficiency. We were finally embarked on the Bournemouth Belle at 4.40 p.m., the outcome being that it took me three times as long to get from Hurn to my house in Purley as from Rome to Hurn. On the whole I prefer Qantas to B.O.A.C.—their diversions are much more amusing.



Photographed from the Heron's cockpit between Wellington and Auckland: a peak in the distant Kaimanawa Range.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Re-entry of a Gladiator

(From W/C. R. F. Martin, chief test pilot, Gloster Aircraft Co., Ltd.)

YOUR readers may be interested to know that our apprentice school has now nearly completed the task of rebuilding the last flying Gloster Gladiator.

Previously this aircraft has been seen flying with a civil registration, but as one of the principal aims of the rebuild has been to put it back to its original operational condition as far as possible, permission was obtained from the Air Ministry to use the Service and squadron markings of the era.

As the Gladiators first went into service in the summer of 1936 with Nos. 72 and 3 Sqns. we are proposing to put on 72 Sqn. markings. It has proved unexpectedly difficult to discover exactly how these markings were arranged relative to the roundels and aircraft numbers, so may we appeal for help from any reader who may have a photograph of a Gladiator so marked?

One further small point. What records we have show this particular aircraft number as L.8032. However, one batch of production aircraft was numbered K.7892-8077 and it seems possible that the K has been corrupted to L. Were there in fact any L-series Gladiators?

The cockpit equipment now includes the original reflector gunsight, oxygen system, TR.9 wireless set, and cockpit lighting. The only principal cockpit items now missing are the two air-release valves and the reservoir and plunger for the gun synchronizing gear.

Gloucester. RICHARD MARTIN.

Eastern Prayer Wheels

THE caption to the picture of the East German B.B.152 on page 684 of *Flight* for May 16 refers to the adjustable rear truck which permits the aircraft to "pray" on take-off. Does that mean it extends so that the nose goes down in the praying postures of the East or does it retract and allow the aircraft to "beg" for an adequate runway and a favourable "climate"?

London, N.W.2. L. F. E. C.

The Grade Monoplane

I CANNOT understand one remark made by Mr. F. Smith (May 16). He says: "I cannot accept for one moment that the Grade machine was intended to land upside down deliberately, as the tailwheel was not repeated above the fuselage." Surely, if your correspondent looks at Roger Bacon's page (February 21) both tailwheels could hardly be more clearly shown.

I am sure that the three additional wheels were fitted *to this particular Grade monoplane* with the intention of landing the machine in the inverted position. It was to be a spectacle in much the same way that wing walking and climbing by ladder from one machine to another were performed as stunts in that era.

In the normal Grade aircraft, the pilot sat beneath the wings and the fact that he is located in the position shown in the photograph in question is, perhaps, another pointer towards a desire to make the machine symmetrical longitudinally. Note, too, that the "landing wires" (in the picture) are angled similarly to the "flying wires" and are as numerous.

Further, in this picture the engine appears to be inverted (not a normal Grade practice) and it looks as if the pilot is going to make the take-off with the aircraft inverted and land it in the normal configuration. I say "it looks . . ." and this is pure surmise, of course, but I have no doubt as to the purpose of the additional wheels.

Potters Bar, Middx. A. H. CURTIS.

Government and the Industry

NOW that the Government has finally pronounced its indifference to the fate of our aircraft industry—last year its top dollar-earning source—I would respectfully suggest that the S.B.A.C. emulates the politicians' example and convenes its own summit conference.

These talks, between the directors/chief designers, etc., of our major companies could—without any assistance from Government subsidy—promote a concerted effort to produce airliners and combat-aircraft exclusively for the North American market. Already, with their inquiries regarding the shelved "Swallow" project at Vickers, the U.S. defence chiefs have shown a preference for British design.

With only their drawing-boards by which to feel the industry's pulse, many of my fellow aircraft-draughtsmen knew instinctively that 40 per cent of our best firms were *en route* for the doldrums. It was evident several weeks before Supply Minister Aubrey Jones made his statement in the House.

Our drawing-boards are becoming markedly bare—although the production side of most firms have some three to five years of work left on existing contracts.

Unless something on the lines of our own summit talks are evolved, the only likely alternative for an industry skilled in light alloys must be railway-carriages, caravans, refrigerators or kitchen furniture.

It is obvious that if our motor industry can thrive and export more in the face of an American recession, the aircraft industry can do the same.

St. Albans, Herts. WILLIAM RICHARDSON.

Retractable Wings

AMONG recent Press comment on the Swallow aircraft, as designed by Dr. Barnes Wallis of Vickers-Armstrongs, is a statement that retractable wings for aircraft are not a completely new conception, and that an aircraft embodying the principle was first flown in America in 1951. (The broad idea, of course, is the provision of a larger wing area, or increased angle of incidence, or both, for take-off and landing than is required in normal flight, as yet another contribution to the perennial search for added safety.)

Yet again that old adage: "There is nothing new under the sun" inexorably crops up. The present writer conceived this idea as long ago as 1917. It is illustrated, described and claimed in his British Patent Specification No. 111, 691, *Improvements in and relating to Variable Wing Surfaces for Aeroplanes*, applied for on April 26, 1917, and accepted on December 13 of that year.

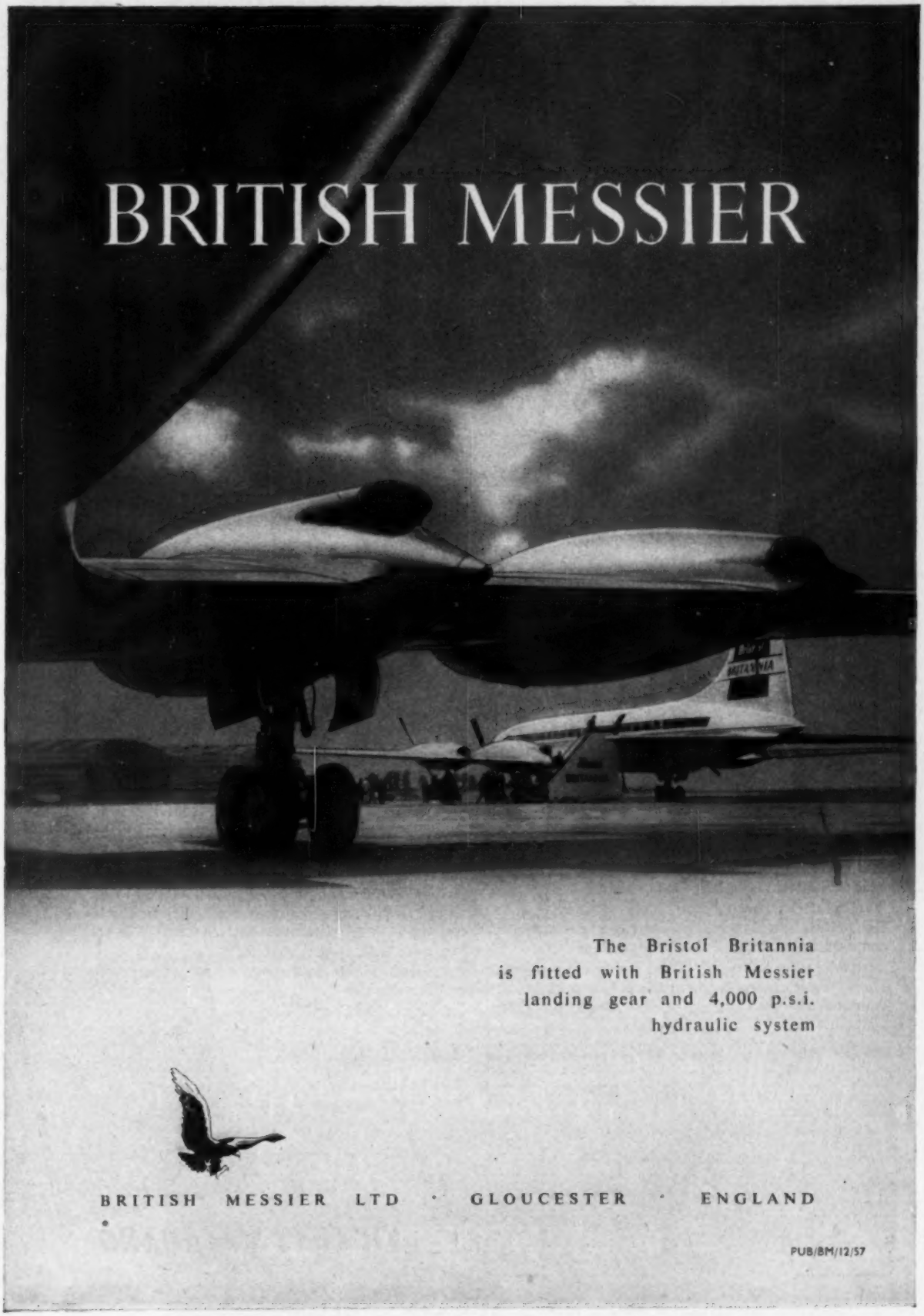
In 1917 there was no Air Ministry. An "Air Board" (brought into being by the exigencies of the 1914-18 war) was the Government department that officiated in connection with the then infantile aircraft industry. Naturally, the writer submitted the invention to that body, and also to committees and panels of experts set up to examine war inventions—with the usual result, on which he does not propose to comment.

One of the commonest occurrences in connection with invention is that when some device is hailed as the latest marvel, be it in aeronautics, automobile, submarines or what-not, a little delving into patent specifications of the past will frequently disclose the fact that the basic principle of this new device is, metaphorically speaking, as old as the hills.

London, S.W.17. E. V. HAMMOND.

FORTHCOMING EVENTS

May 25-June 1. Aéro Club de l'Ouest: d'Angers Gliding Competition.
May 29-June 1. R.Ae.C.: International Invitation Rally, Shoreham.
May 31. R.Ae.S.: Chester Branch: Aeronautical Show and Garden Party, Broughton.
June 1. Royal Belgian Aero Club: International Balloon Meeting.
June 1-3. Aéro Club de France: Helicopter Rally.
June 4. Kronfeld Club: Lecture by David Ince.
June 6. Helicopter Association: "Turbine Helicopters," by D. L. Hollis Williams.
June 7-8. Aéro Club de France: Normandy Rally.
June 7. Helicopter Association: Garden Party and Rally, Dunsborough Park, Ripley, Surrey.
June 8. Royal Dutch Aero Club: Balloon Trophy Competition, Rotterdam.
June 8. Wolverhampton Aero Club: Members' Competition Day.
June 14. Plymouth Aero Club: Air Display.
June 14-15. Popular Flying Association: Rally, Rhoose, Cardiff.
June 15-29. World Gliding Championships, Poland.
June 18. Kronfeld Club: "The Early Days," by F. N. Slingsby.
June 19-28. OSTIV: Seventh Congress, Osieczna, Poland.
June 20-23. Lerida Aero Club: International Tour of Pyrenees.
June 20-23. Palermo Aero Club: Tour of Sicily.
June 21. R.N. Air Station Ford: At Home.
June 22. R.Ae.S.: Garden Party, White Waltham.
June 25. Kronfeld Club: Polish film, "The First Start."
June 27-29. Royal Dutch Aero Club: International Rally.
June 28. Exeter Aero Club: Flying Display, Exeter Airport.
June 28. R.A.F.A. (Cheltenham and Gloucester Branches): Air Display, Staverton Airport.
June 28. R.N. Air Station Abbotsinch: At Home.
June 28-29. Fliers Aero Club: Normandy Rally.
June 28-30. R.Ae.C.: Private Air Rally, La Baule.
July 5. NATO Air Display: Soesterberg, Holland.
July 5-6. Aéro Club de l'Ouest: Anjou Wines Rally.
July 5-7. R.Ae.C.: Private Air Rally, Deauville.
July 8. Kronfeld Club: Welcome home to British gliding team.
July 8-11. Institute of the Aeronautical Sciences: National Summer Meeting, Los Angeles, Cal.
July 10-12. R.Ae.C.: National Air Races and Lockheed International Aerobatic Competition, Baginton.
July 12-14. Royal Dutch Aero Club: Camping Rally.
Sept. 1-7. S.B.A.C. Display and Exhibition, Farnborough.


BRITISH MESSIER
The Bristol Britannia
is fitted with British Messier
landing gear and 4,000 p.s.i.
hydraulic system
BRITISH MESSIER LTD · GLOUCESTER · ENGLAND
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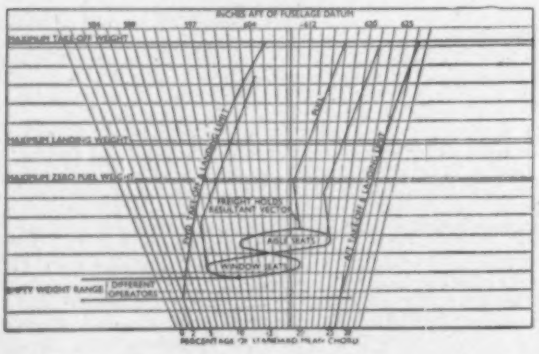
All this FREIGHT from a PASSENGER aircraft?

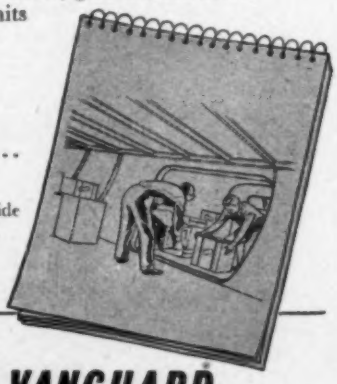
Yes, it's the VANGUARD

The ability to carry up to 120 passengers or ten tons of freight (density 15 lb. per cubic foot), will ensure profitable operation of the VANGUARD, winter and summer, day and night — even when passenger traffic is at its lowest ebb. With a combined capacity of 1,360 cubic feet, the two spacious holds in the 'double-deck' fuselage give ample room to arrange the freight conveniently in separate destination groups. The exceptionally wide freight doors, situated on the side opposite the passenger doors, give unobstructed access for simultaneous loading and unloading. The very wide C.G. range permits maximum flexibility of passenger and cargo loading. The 'loading loop' below shows the ideal matching of the C.G. limits which is possible with the Vanguard — yet another reason why the Vanguard is the airline's airliner.



For your notebook...

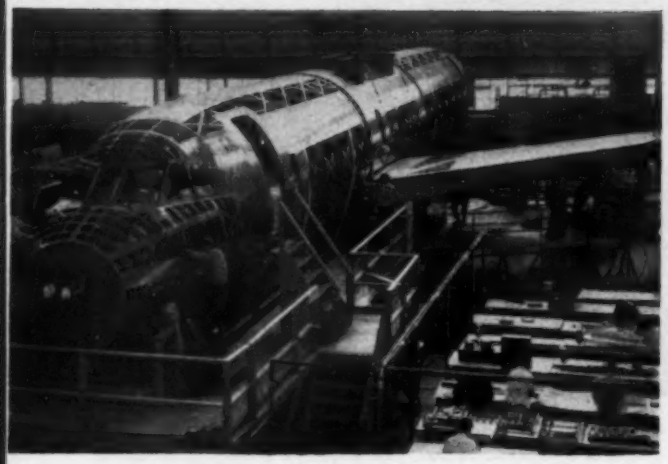
Each freight hold has an unobstructed access 5ft. 6in. wide and 3ft. 10in. projected height. Headroom inside is 4ft. 3in.



VICKERS VANGUARD

Four Rolls-Royce Tyne Propeller-Turbine Engines

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY



Trial installations of systems and furnishings for Convair's 880 are proved in this metal mock-up, built mainly from production parts in production jigs. Exceptions are the use of much thinner skinning.

CIVIL AVIATION

HUNTING'S TWIN-JET P.107

IT has been known for some while that Hunting Aircraft are considering the possibilities of a twin-jet transport. The existence of such a design was reported in *Flight's* "Commercial Aircraft of the World" special issue of November 1 last year, but until very recently no official confirmation has been forthcoming from Hunting. Writing in the current *Hunting Group Review*, Mr. W. A. Summers, managing director of Hunting Aircraft, confirms that the firm have for a long time thought that "a good proposition" might be a twin-turbojet transport with 40 seats and a range of 600-800 miles. An extensive design study was undertaken and the aircraft which emerged is now designated P.107. It has been "modified considerably," says Mr. Summers, "from our first thoughts" (which were reputedly around an executive jet powered with two Bristol Orpheus—the formula to which Lockheed's executive Jetstar was developed).

The possibilities of a small jet transport for the mid-1960s seem to be brightest in the Friendship or turboprop Convair replacement market. The more sophisticated short-haul airlines which are now re-equipping with turboprops seem likely to start introducing jets on to their networks in five or six years' time. The present rate of growth of the more successful carriers should make jet re-equipment feasible if the design is tailored to their needs, particularly in respect of seating capacity and runway performance. The P.107 could well fill the gap that now exists between the small-capacity, long-range executive jets (Jetstar, Sabreliner) and the short-haul trunk line transports such as the D.H. 121, Bristol 200 and Caravelle. It is now well understood that during the useful life of a basic design, larger and heavier variants are developed to suit trunk-line needs and early aircraft are progressively passed on to smaller carriers. The tendency is most clearly marked with the Douglas series of designs, but the same evolutionary process is applicable to the Viscount. A 40-seater jet (with ample possibilities for design stretch) can be considered as touching the lower-capacity fringe of the Viscount replacement market.

Such an aircraft would sell at about £250,000 with 90 aircraft set as the break-even number for recovery of development costs, which (suggests Mr. Summers) would be between £4m to £5m for design, testing, proving and tooling for production. Financing on this scale, he says, can only be done by two or three companies getting together to make a joint venture in which risks and liabilities are adequately spread. The companies need not lose their identities through amalgamation; a new theory of consortium and integration to undertake new projects can be worked out much in the way that de Havilland, Fairey and Hunting have done with the D.H. 121.

SEABOARD'S IRISH INVESTMENT

THE issued capital of Aerlinte Eireann—all of which is at present held by the Irish Government through a State-owned holding company, Aer Rianta—is to be increased from £1,425,000 to £1,925,000, the additional capital representing an investment of £500,000 by Seaboard and Western Airlines, Inc. The revised structure will give Seaboard and Western a 26 per cent share in Aerlinte Eireann and the right to a single seat on Aerlinte's Board (or two seats if the Board's membership is increased to seven). Although Seaboard's holding will be transferable to another investor, this would not include the right to be represented on Aerlinte's Board.

Aerlinte's services are already being operated by Seaboard and Western Super-Constellations on charter. The new financial arrangement will bring the two companies even closer together. Commenting on this development, Mr. J. F. Dempsey, Aerlinte's general manager, said: "It is a most encouraging vote of confidence in the operation and particularly gratifying as this is the first private investment in air transport in Ireland."

Before becoming final, the transaction must be approved by the C.A.B.—a body whose attitude must be conditioned by its recent dispute with Seaboard concerning charter flights operated under Aerlinte's colours.

AUSTRALASIAN FURORE

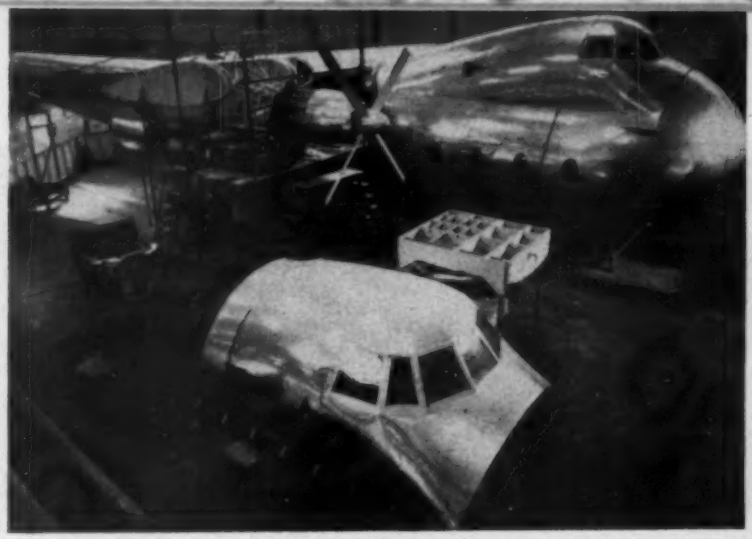
IF a report in the Australian *Melbourne Sun* is proved by events to be correct and Ansett-A.N.A. is allowed, after all, to have at least two Electras, the Australian cabinet will have performed a sharp about-face. They had earlier (see *Flight*, April 25) rejected Ansett-A.N.A.'s application for Electras and disallowed T.A.A.'s import of Caravelles; the latter action, it appears, largely upon the advice of Mr. Ansett himself, who appealed to the Government to adopt "a cautious and conservative approach" and warned that if T.A.A. bought jets, his airline would be forced to follow suit. His argument was accepted to the extent that it was applied to his own Electra purchase, which was rejected on the grounds that "their introduction into service on short range routes could only add substantially to the overall costs of national transport."

The furore which greeted the Government's decision to overrule the equipment decisions of its domestic airlines apparently caused at least some relaxation in the attitude of Senator Paltridge, Australia's Minister of Civil Aviation; four days after his original statement he told Mr. Ansett that he was prepared to give further consideration to a written application from the airline for the purchase of Electras. T.A.A. and Ansett-A.N.A.'s re-equipment plans are still undecided, and it seems unlikely that either will make a move towards ordering Viscount 810s, which they consider are not suitable for their needs. Both airlines want to operate a larger aircraft than the Viscount and they hope to resuscitate the growth-rate of Australia's air traffic by offering immediate 400 m.p.h. travel. If, as now seems increasingly likely, both airlines are permitted to buy Electras, Lockheed will have a large stake in the Australian market: Ansett-A.N.A., T.A.A., Qantas and probably T.E.A.L. operating Electras, and Neptunes and C-130s in service with the R.A.A.F. The aircraft manufacturer is establishing a sales directorate in Sydney to further its interests in Australia and the Far East.

Aerlinte's flagship, named after Ireland's patron saint, seen at Dublin. "St. Patrick" is the first of three L.1049Hs to be chartered from Seaboard and Western Airlines.

CIVIL AVIATION . . .

Swinging Ahead with the AW.650



This metal-skinned mock-up of the AW.650 at Baginton gives a good indication of the new transport's size. A Rolls-Royce Dart RDa.7 powerplant (identical to that of the Viscount 810) is now being installed, and the fuselage-interior was last week being used to determine the layout of flight-test equipment and ballast. First production aircraft will fly before the end of the year; four will be flown during the next 12 months.

THE AW.650 is more than an interesting new commercial transport. Although the Hawker Siddeley Group conceived it two years ago, it stands forth today as the embodiment of two highly topical trends: first, it exemplifies the industry's transition to privately financed civil business; second, it seems to represent the right kind of answer to air transport's need for a breakaway from costly "quality-competition."

WITHIN two or three days of the schedule laid down 18 months ago, the structure of the first AW.650 Freightercoach has been completed, and is now in the equipment department of Armstrong Whitworth's production factory at Baginton. "Right on schedule" is the way in which Mr. H. M. Woodhams, Armstrong Whitworth's managing director, last week described progress with his firm's new private-venture transport, design of which was completed two or three months ago. The aim is to roll out the first aircraft in the autumn, and to fly it before the end of the year. Thereafter, four aircraft will follow at monthly intervals: the first three are allocated to the flight-test programme, which is scheduled to culminate in A.R.B. and C.A.A. airworthiness certification in the early part of 1960. The fourth aircraft, already just appearing on the jigs, will be handed over to the sales department as a full-time demonstrator. Its debut in this rôle will, A.W.A. hope, be made at the XXIII[e] Paris Salon in twelve months' time. Subsequently it will embark on a comprehensive sales-demonstration tour of Europe, the Middle East, Far East, and North and South America.

The initial production programme calls for the completion of ten 650s, plus a further two fuselages for structural tests. These are destined for the test-tanks; one fuselage will be subjected to static-strength tests to destruction, and the other—as a complete airframe with wings, powerplant, undercarriage and tailplane attached—will undergo the customary fatigue tests. A.W.A. are making a strong claim for the fatigue life of their new aircraft: "The primary structure is so designed that a fatigue life of 30,000 hours shall be achieved on typical high altitude short range stages, e.g., 500 n.m. cruising at 25,000ft. The life for low-altitude, very short range operations is correspondingly reduced, whilst that for long range high altitude stages is improved over the 30,000 hour life. This means that during this period none of the structure integral with the airframe such as the wing, fuselage, tail-booms and tail unit will fail through fatigue giving subsequent catastrophic structural collapse."

Considering the short-haul nature of the aircraft's purpose (i.e., more landings and more pressurizations in the course of its working life), this is a noteworthy objective. A.W.A. are building their own test-tank facility at Whitley, the firm's aircraft and G.W. design centre two miles from Baginton. Costing some £60,000, it will comprise two tanks and a control-building serving both. The "static" tank and control building are now nearly finished, and the foundations for the fatigue tank are laid.

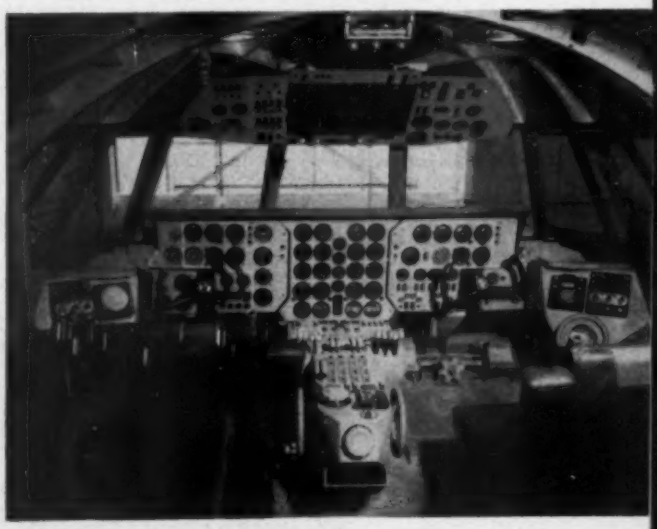
An urgent sense of purpose and hustle is apparent in the production shops at Baginton, where 27 per cent of the total production labour force is now concentrated on AW.650 work. This proportion is rising steadily, notwithstanding the considerable Group military work continuing in hand at Baginton (including major components for the Sea Hawk, Hunter, Vulcan, Javelin and so forth). It is generally acknowledged that A.W.A.'s reputation for production is one of the highest in the industry; to quote one of the firm's production executives: "We are trying to do even better on the 650." The complete building cycle is broken down into nine stages, each with a project number and target-date. This is displayed on one piece of paper to which everyone on the shop-floor can refer. The labour force is surpassing all previous records in getting on with the job. A production project engineer has been appointed to co-ordinate the initial "build," and to iron out the snags which inevitably arise on the early part of the learning curve; an economy committee is charged with keeping down costs; and a special development committee, headed by the chief designer and meeting fortnightly, is responsible for the overall management of the project.

The contribution which the Group as a whole is making to the AW.650 is apparent both in design and fabrication. Avro have full responsibility for design and production of the wing (which is a derivative of that of the Shackleton); Glosters are responsible for the design of the tail-booms and tailplane, though these are actually manufactured by A.W.A.

Final AW.650 assembly and flight-testing will take place at A.W.A.'s large factory-airfield at Bitteswell, 14 miles from Baginton. The first fuselage and wing are due to be joined there during July.

An intensive wind-tunnel test programme is in hand at Baginton. Most of the basic work on wooden models and sections has now been completed in the 90ft/sec open-ended tunnel, but a detailed investigation of a powered model is soon to start. This is a high-precision metal model, now nearly finished, and probably one of the most elaborate of its kind. Costing some £2,000, it is powered by a 1 h.p. electric motor driving the propellers via miniature shafting at up to 12,000 r.p.m. Tunnel tests of the 650's variants—the 660 (military version with redesigned rear door for opening in flight) and 670 (vehicle-ferry and 126-passenger air bus version)—are also well advanced. In progress at present are tunnel-tests on the 650 to establish the optimum rear end from the points of view of drag and door-opening geometry. The original beaver-tail arrangement of the 660 may be considerably modified in the light of these tests, and an ingenious door has been devised to fold out of the way for supply- and troop-dropping, and to be used as a ramp for ground-loading.

A.W.A.'s commercial hopes for the 650 may be summed up as



There are two detailed mock-ups of the AW.650's cockpit: this shows the standard two-crew layout; another (in the canopy-section shown in the foreground of the above picture) is devoted to an American-style layout with an engineer's station.

"quietly confident." No firm orders have yet been placed, though an encouraging amount of interest—including letters of intent-to-purchase—has been shown. The firm has completely revised its sales organization to meet the stiff challenge of the civil aircraft business, and technical sales teams have been in the field continuously during the past 18 months. The prime emphasis of their effort has been upon promoting the advantages of the 650 as a low-cost vehicle for the development of freighting. Promotion of the aircraft as a passenger airliner has been secondary, though its suitability for mixed passenger and freighting operations—the way in which most airlines have developed air freight in the past—is obviously a strong point being stressed.

Among the airlines which have shown more than a passing interest in AW.650 and its variants are B.E.A., for the replacement of its DC-3-Pionair Leopard freighters; Silver City and Air Charter, the two British independents who are particularly interested in the 670 vehicle-ferry and air-bus variant; K.L.M. and Sabena, for intra-European freighting (Sabena are also an associate of Air Charter in the Channel Air Bridge operations); and N.Z.N.A.C., for the development of air traffic across the Cook Strait. The interest in the 660 military version has also been encouraging; a possible breakthrough into the military market—which A.W.A. have had kept in mind since the conception of the project—would be of inestimable value to the civil production programme.

First cost of AW.650 is now set below the £500,000 mark. As regards the total market, A.W.A. hope to sell at least 250 aircraft. Such a figure is bound to be speculative; but it might not be complacent to suggest that the AW.650, as the kind of transport which is not likely to be technically outpaced for many years hence, may well exceed its sponsor's hopes.

NORTH ATLANTIC TRAFFIC STATISTICS

FOR some years I.A.T.A. has been under pressure to publish more frequent and comprehensive statistics on North Atlantic traffic. The form in the past has been that each I.A.T.A. airline operating regularly across the North Atlantic has sent a weekly return to I.A.T.A.'s New York office. There all the information is collated and distributed to the participating airlines. Although obtained and published as being confidential, these statistics everywhere seep through to the offices of the world's aviation magazines, although in only a few cases is the confidential nature of the information abused.

Of late, the airlines have become increasingly willing to issue details of their traffic—in many cases such details have been contradictory—and it is, therefore, a pleasure to record that I.A.T.A. is now publishing quarterly traffic summaries.

No quarter could have been more appropriate for starting this service than that just completed. Not only was the industry suffering from widespread recession, but tourist passengers were sensibly delaying their journeys until economy-class fares were available. Thus traffic increased by a mere 5 per cent as against an increase in capacity of 23 per cent (load factor dropped to 53 per cent). Eastbound traffic was particularly affected: whereas the first quarter's traffic is usually balanced fairly evenly in each direction, in January-March of this year the number of passengers flying to America (85,000) was well in excess of those coming to Europe (74,000). First-class traffic was least affected, and accounted for almost one-half of total traffic as against an annual average of one-quarter last year and an estimated fifth this year. Freight and mail traffic for the quarter increased by 3 and 16 per cent respectively.

URGENT: AIR SPACE POSITIVE CONTROL

FIGURES recently published by the Civil Aeronautics Board show that the American domestic airline passenger fatality rate has dropped by 70 per cent in the past 12 years, and in the past six has averaged less than one death for every 100m passenger-miles. But the occurrence of mid-air collisions does not yet appear to show a satisfactory decline. The T.W.A. Constellation and United DC-7 Grand Canyon accident in June 1956, and the collision between a U.S.A.F. F-100 and a United DC-7 over the Nevada desert last month (in which tragedies, respectively, 128 and 49 people lost their lives) are grim testimony to the scale of disaster which follows failure to achieve 100 per cent operational safety. And on Tuesday of last week all 11 occupants of a Capital Airlines Viscount flying between Chicago and Pittsburgh were killed near Brunswick, Maryland, in another accident resulting from a mid-air collision—in this case involving a T-33 jet trainer of Maryland National Guard. In all, report the C.A.B., there have been 159 collisions in the past ten years, and 971 near-misses were reported in 1957 alone.

House of Representatives investigators into the Nevada accident blamed lack of co-ordination between civil and military air traffic controls. They demanded that the U.S.A.F. and C.A.B. should work out new control procedures within 60 days, and that a single civilian agency should eventually regulate all the airspace for all types of aircraft. Military flying, the investigating committee agreed, should be controlled in the vicinity of Federal airways "in good as well as instrument weather."

In urging the application of positive airspace control, the committee were underlining a policy to which the Civil Aeronautics Administration traffic control office is already committed. The C.A.B.'s report to Congress suggested that an immediate start should be made in establishing an all-weather transcontinental airway 40 miles wide between the altitudes of 20,000 and 35,000ft. At present positive control is applied only on Federal airways or in the Continental Control Area above 24,000ft (introduced last December) and is only obligatory in conditions of limited visibility.

But the rate at which positive control can be brought to bear on the air traffic separation problem is limited both by the money and time available for training men and establishing control aids. The C.A.B. warned those who demanded immediate improvement that to enforce immediate positive control of all airspace would bring 85 per cent of all traffic to a standstill, and the 20,000ft airway proposal appears to be a hurried intermediate step to be taken before lowering the floor of the Continental Control Area to 15,000ft next spring. This in itself is dependent upon the speed at which the 70 long-range radars required for complete area coverage of the U.S. can be established.

Below 15,000ft the application of positive control is limited by a different equipment problem—that of America's largest and most vociferous flying group, the private and business pilots. Yet overall control must eventually be enforced; the C.A.B.'s statement that all but seven of the 159 collisions in the last ten years has occurred below 3,000ft cannot lightly be ignored.

BREVITIES

FIRST flight of the DC-8 is imminent at the time *Flight* goes to press. The crew, who have accumulated 35 hr experience on a cockpit simulator, will be A. G. Heimerdinger (flight operations manager for the Douglas Santa Monica division), chief pilot; William M. Magruder, second pilot; and Paul H. Patten, systems operator.

* * *

The first production Caravelle completed two flights—the longer of four hours—on the day it first flew, May 18.

* * *

A.R.B. have re-issued their Civil Aircraft Inspection Procedure leaflets. The new issue is dated April 1, 1958.

* * *

Work on new runways at Halmsjön, Stockholm's new international airport, was started this month. The original runway will not be used.

* * *

Mr. Frank Saunders, M.B.E., M.I.Mech.E., A.F.R.Ae.S., at present special duties officer to the chief engineer of B.O.A.C., is leaving the Corporation after 35 years with the engineering staff of Imperial Airways and B.O.A.C. He states that he is now free to act in a consultative capacity on equipment design and organization.

The Guild of Air Traffic Control Officers are to hold their second Convention at Southend on October 23 and 24.

* * *

B.E.A. have introduced Viscount 802s on to their Dinard, Bordeaux and Biarritz services.

* * *

Audio and Video Rentals have installed Pye closed-circuit television for flight announcements and advertising at B.E.A.'s West London Air Terminal.

* * *

Seaboard and Western have been authorized by the C.A.B. to carry U.S. mail to the seven European countries which they serve; authorization for westbound mail was granted earlier this year. Mail rates will be those paid to PanAm and T.W.A.

* * *

From Vickers comes news that Ansett A.N.A.'s order for four Viscount 810s is now confirmed, bringing to 383 total announced Viscount sales. The 810 model has now been A.R.B.- and C.A.A.-certificated at weights above Continental's original contract specification. New weights are: take-off, 69,000 lb; max. landing, 62,000 lb; zero fuel weight, 55,500 lb. Continental were due to inaugurate 810 services between Chicago, Kansas City, Denver and Los Angeles on May 28.

SERVICE AVIATION

Royal Air Force and Naval Flying News

Air Marshal Hugh L. Campbell, C.A.S. of the R.C.A.F., and Vice-Admiral H. G. DeWolf, Chief of the Canadian Naval Staff, taking the salute at R.C.A.F. Greenwood, Nova Scotia, when the first Canadair CL-28 Argus aircraft with which the Maritime Air Command is being re-equipped were formally handed over to its A.O.C., A. Cdre. Martin Costello, on May 17.

Minot Trophy Winners

FOUR B-52s of the 92nd Bomb Wing, S.A.C., commanded by Col. Donald E. Hillman, won the Laurence Minot trophy for bombing and navigation last week, in competition with Vulcans and Valiants of R.A.F. Bomber Command. A Valiant of No. 207 Sqn. (S/L. R. W. Payne) won the individual bombing and a B-52 (Major H. Willard) the individual navigation.

Senior Appointments

SINCE 1955 Group Captain (Plans) at F.E.A.F. headquarters, A. Cdre. C. Broughton has been appointed S.A.S.O. at Transport Command H.Q., where he succeeds A. Cdre. R. A. C. Carter, who has held that post since late 1955 and now becomes Director of Personal Services (A) at the Air Ministry. In this appointment, A. Cdre. Carter succeeds A. Cdre. D. Finlay, who is to become Commandant of the Aircrew Selection Committee at R.A.F. Hornchurch.

Tengah - Ohakea Changeover

FROM June 30 the distinctive markings on the Venoms of No. 14 Sqn., R.N.Z.A.F. (white kiwi on a black background on the rudder, black-and-white diamond on the fuselage) will be seen no more at R.A.F. Tengah, Singapore; after four-and-a-half years' anti-terrorist operations from there the squadron is returning to New Zealand and will be replaced as from July 1 by No. 75 Sqn., R.N.Z.A.F., based at Ohakea and at present re-equipping with Canberra B.2s. Most of No. 14 Sqn.'s ground crew are, however, remaining at Tengah to service the Canberras as members of No. 75 Sqn.

No. 14 Sqn. came to Tengah from Cyprus, where it had been sent after the war following a major change in New Zealand defence policy, all N.Z. units having previously been home-based in peacetime. During the war, the squadron's Kittyhawks and Corsairs had operated with U.S. forces at Guadalcanal and in Bougainville, recording 25 "kills"; and in 1946 the unit was one of the first concerned with the occupation of Japan. When the squadron moves back to New Zealand it will be based at Ohakea, thus "swapping bases" with its successor at Tengah. Six pilots and ten navigators of No. 75 Sqn. are at present being trained on Canberra B.2s at R.A.F. Bassingbourne, Cambs, with four former pilots of No. 14 Sqn.

Radar Frigate

THIRD of the *Salisbury* class frigates (designed primarily for the direction of carrier-borne or shore-based aircraft) to be completed, H.M.S. *Chichester* was provisionally accepted into R.N. service at Glasgow on Friday, May 16. The new frigate is armed and in addition to her aircraft-directing function can be used as a small destroyer in offensive operations.

Vulcans' Performance

BRIEF reference was made on this page last week to a message sent by A.V-M. G. A. Walker, A.O.C. No. 1 Group Bomber Command, to Mr. J. A. R. Kay, general manager of A. V. Roe and Co., Ltd., about the performance of the Avro Vulcans of No. 83 Sqn. on their recent trip to South America. In his letter the A.O.C. wrote:—

"The fact that we flew from Waddington to Buenos Aires in 13 hours' flying time with only two intermediate stops (Dakar and Rio) amazed even knowledgeable aviation circles in South America. No one could get it straight that we had flown direct from Dakar to Rio and *vice versa* on return." The Vulcan crews allowed two hours five minutes for the flight from Rio to Buenos Aires—a distance of 1,240 s.m.—and, says A.V-M. Walker, "we were absolutely on time."

Edinburgh "At Home"

FOR the first time since it was formed in 1941, Edinburgh U.A.S. on May 18 held an "open day," which included flying competitions at Turnhouse. The Gardiner Trophy (presented recently by a former member, P/O. R. B. Gardiner) was won by Cdt. Plt. G. Battson, who scored 90 marks out of 100 for a forced landing from 2,000ft, and the Duke of Sutherland's Cup (for spot landings by a first-year member) by Cdt. Plt. P. W. Lambie. The judges were W/C. R. C. Haine, station commander at Turnhouse, and S/L. K. R. Richardson, C.O. of Durham U.A.S.; and the awards were presented by Sir A. D. Buchanan-Smith.

Air Marshal F. R. W. Scherger, C.A.S. of the R.A.A.F., presenting the Gobel Flying Trophy to Sgt. Plt. B. Newman at the R.A.A.F. Advanced F.T.S.—which is now, with the replacement of Wirraways by Vampires, being transferred from Point Cook to Pearce, W.A.

A full-scale model Bloodhound at R.A.F. West Malling, where rehearsals are being held for a display at this year's Royal Tournament (Earls Court, June 4-21) showing what would happen at a guided missile station from the first radar warning of enemy attack.

Education Branch Dinner

WHEN the R.A.F. Education Branch held its tenth annual dinner on May 9 the principal guests included Air Chief Marshal Sir Thomas Pike, A.O.C-in-C. Fighter Command; Air Marshal Sir John Whitley, Air Member for Personnel (who replied to the toast of "The Guests," proposed by A.V-M. A. C. Kermode, Director of Educational Services); and Air Marshal Sir Denis Barnett, the Air Secretary.

Recent Postings

AMONG appointments recently announced by Air Ministry are the following:—

G/C.s B. H. Boon to H.Q., Maintenance Command, for air staff duties; W. S. Reed to H.Q., Fighter Command, for technical staff duties; G. L. S. Griffith-Jones to H.Q., Coastal Command, for air staff duties; J. H. Iremonger to H.Q., No. 12 Group, for air staff duties; P. R. Beare to R.A.F. Tern Hill, to command; R. E. Beeny to the Air Ministry, for duty in the Department of the Air Member for Supply and Organization; R. J. B. Burns to the Air Ministry, for duty in the Department of the Air Member for Personnel; R. H. C. Burwell to H.Q., Coastal Command, for air staff duties; W. Carter to the Joint Services Staff College, as senior R.A.F. member of the Directing Staff; W. K. Stewart to the R.A.F. Institute of Aviation Medicine, to command; R. Trippett to H.Q., Bomber Command, for administrative staff duties; J. Wallace to R.A.F. Bawdsey, to command; G. P. Harger to R.A.F. Horsham St. Faith, to command; H. E. Hopkins to H.Q., Home Command, for air staff duties; T. S. Kennedy to H.Q., Fighter Command, for administrative staff duties; A. P. Chamberlain to R.A.F. Locking, to command; A. D. Jackson to H.Q., M.E.A.F., for air staff duties; K. A. Merritt to R.A.F. Weeton, to command; and D. G. Scott to the Ministry of Supply.

W/C.s H. E. Barker to AAFNE, for staff duties; A. B. Bishop to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; D. W. J. Brown to H.Q., M.E.A.F., for administrative staff duties; J. H. Cocks to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; T. P. Gibson to H.Q., Fighter Command, for administrative staff duties; N. A. Gwyther to H.Q., 2nd T.A.F., for technical staff duties; G. V. W. Kettlewell to R.A.F. Watton, for administrative duties; H. W. Lamond to H.Q., No. 90 Group, for administrative staff duties; C. A. Alldis to H.Q., Bomber Command, as Chief Intelligence Officer; J. M. Ayshford to Air Ministry, for duty in the Department of the C.A.S.; J. M. Daniel to Air Ministry, for duty in the Department of the Air Member for Personnel; J. P. Beale to AFNE, for staff duties; J. A. Hunter to H.Q., Flying Training Command, for administrative staff duties; G. A. Martin to R.A.F. Stradishall, to command No. 89 Sqn.; A. D. Miller to R.A.F. Scampton, for technical duties; A. C. Rawlinson to R.A.F. Patrington, to command; S. J. Popham-Pursey to Air Ministry, for duty in the Department of the Air Member for Supply and Organization (with acting rank of group captain); R. I. Alexander to Air Ministry, for duty in the Directorate of Work Study; R. T. Billett to R.A.F. St. Eval, for flying duties; T. S. Kitching to Ministry of Supply; J. T. Lawrence to the Aircraft Department, Royal Radar Establishment, Ministry of Supply, Pershore; I. N. M. Macdonald to Air Ministry, for duty in the Department of the C.A.S.; J. N. Stacey to the R.A.F. Staff College, Bracknell, for directing staff duties; K. W. J. Tarrant to the Joint Tactical School, Malta, as Assistant Director; R. J. H. De-Brett to H.Q., M.E.A.F., for air staff duties; G. W. M. Dunn to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; J. H. Fowler to H.Q., British Forces Arabian Peninsula, for administrative staff duties; W. O. Hill to H.Q., U.S.A.F., on exchange duties; and P. G. D. Taylor to R.A.F. Bridgnorth, for administrative duties.

S/L.s V. W. A. Matthews to H.Q., Maintenance Command, for administrative staff duties (with acting rank of wing commander); G. M. Howard-Jones to Air Ministry, for duty in the Department of the Air Member for Personnel (with acting rank of wing commander); R. A. N. McCready to R.A.F. Seletar, for flying duties (with acting rank of wing commander); G. Packe to R.A.F. Sutton-on-Hull, to command (with acting rank of wing commander); A. J. Cunningham to H.Q., M.E.A.F., for administrative staff duties (with acting rank of wing commander); C. L. C. Mason to H.Q., 2nd T.A.F., for administrative staff duties (with acting rank of wing commander); F. Vernon to H.Q., No. 22 Group, for administrative staff duties (with acting rank of wing commander).

Wg/O. F. R. Pentland, W.R.A.F., to H.Q., Fighter Command, for administrative staff duties; and Sq/O. B. C. Turier, W.R.A.F., to H.Q., Bomber Command, for administrative staff duties (with acting rank of wing officer).

Whirlwinds of No. 701 Sqn., F.A.A., approaching Eastney beach, Southsea, during "Run Aground IX"—a series of demonstrations held to show Staff College students some of the methods and equipment used in amphibious operations. In the foreground is a tank recovery vehicle.

Telling the Air Minister, Mr. George Ward, something of their South Pole experiences (with the aid of an inverted globe) are members of the R.A.F. Antarctic detachment: S/L. J. H. Lewis, the C.O. (centre); and from left to right, F/Sgt. E. Williams and F/Sgt. P. B. Weston (who were in charge of maintenance) and F/L. G. M. Haslop, who is a New Zealander.

IN BRIEF

A NATO air exercise, code-named "Full Play," is to be held over the U.K., Belgium, Luxembourg, France, Western Germany and the Netherlands from June 2 to 5.

* * * * *

The West German Federal Defence Ministry has requested the services of up to 100 R.A.F. flying instructors for the German Air Force, and negotiations are in progress.

* * * * *

No. 413 Sqn., R.C.A.F., has been awarded the Steinhardt Trophy as the most efficient all-weather intercepter squadron in Canada. Based at Bagotville, P.Q., the squadron is equipped with F-86 Sabres.

* * * * *

Any ex-member of No. 96 Sqn. who is interested in purchasing a squadron tie—price 16s, inclusive—should forward a cheque or P.O. for that amount to the Adjutant, No. 96 Squadron, R.A.F., B.F.P.O.40.

* * * * *

The former R.N. frigate *Oakham Castle* was re-named *Weather Reporter* by Lord Hurcomb, chairman of the Meteorological Committee, at Greenock on May 16 and on May 20 was to begin her first tour of duty as one of the four British weather ships in the North Atlantic.

* * * * *

W/C. T. A. J. Stocker, who since 1956 has been taking the course at the U.S.A.F. Institute of Technology Resident College at Dayton, Ohio, was recently awarded the Air University Badge as one of three distinguished graduates of the March 1958 class.

* * * * *

The first of the 1,000 R.A.F. badges which are being set into the floor of the R.A.F. church, St. Clement Danes, was placed there on May 19 by Miss Madge Whiteman. She was invited to do this by the Rev. Canon A. S. Giles, R.A.F. Chaplain-in-Chief, in recognition of having carved 88 of the badges.

* * * * *

S/Tech. John Bull, who six months ago (and for the second time in less than a year) won the Curtis Memorial Prize for the best results achieved by an airman or airwoman in the half-yearly G.C.E. examinations, has been awarded a State Scholarship. At present stationed at R.A.F. Abingdon, he intends to read for a social science degree when he leaves the Service shortly after 12 years.

Palmer Fluoroflex PTFE hose (see col. 1) under 100-hour test at 100 vibration impulses per minute, pressure variations from 0 to 3,000 lb/sq in, ambient temperature of 120 deg C, and independent vibration of one end through 010in at 7,500 cs/min. A 915-hour test under even more severe conditions followed.

THE INDUSTRY

New Hydraulic Hose

WHAT are stated to be the first entirely British-made dispersion-polymer PTFE hydraulic hoses are now being marketed, under the trade name "Palmer Fluoroflex," by Palmer Aero Products, Ltd., of Herga House, Vincent Square, London, S.W.1. Previously obtainable only from dollar sources, they are being made available, to users both at home and overseas, with swaged-on or reusable end-fittings.

Constructed from a new fluorocarbon resin compound, and armoured with stainless-steel wire braid, the hoses will carry a wide variety of engineering solvents, hydraulic fluids, acids and H.T.P., and have a remarkable combination of chemical, physical, thermal and electric properties. They are further stated to be completely unaffected by all chemicals except molten alkali metals and fluorine at elevated temperatures and pressures; to operate over pressure-ranges up to 10,000 lb/sq in; to withstand temperatures from −100 deg F to +500 deg F; and to be non-ageing, non-flammable, water repellent and capable of withstanding prolonged flexing and vibration.

Miniature Connectors

Six-way and 25-way connectors.

ILLUSTRATED here is one of the new range of miniature M4 aluminium plugs and sockets now being produced by J. N. Somers, Ltd., of 142-8 Edgware Road, London, W.2 (of which company, incidentally, racing pilot Nat Somers is a director). The connectors are made in three sizes—small (2-, 3-, 4- and 6-way), medium (4-, 6- and 12-) and large (18- and 25-) and are pressure-tested at 20 lb/sq in, with leakage-rate guaranteed not to exceed 1 c.c./hr. Flash tests at twice the working voltage plus 1,000 V are also made. Inspection, test and release are to the relevant M.o.S., A.I.D. and inter-Service requirements. Any required ancillary parts are also available.

Rumbolds Entertain

WHEN Mr. and Mrs. L. A. Rumbold recently gave another of their parties to senior staff and friends from the industry it proved, like its predecessors, to be not an occasion for long speeches; and Mr. Rumbold's only retort to Mr. T. O. Jones' reference to him as "a pioneer of aircraft furnishing" was to say, "I did not know I had done so much, but we have done our best." He then congratulated Mr. R. S. Stafford on being appointed a director of Handley Page, and extended a special welcome to Mr. and Mrs. Barto of Fokkers.

Replying to Maj. Jack Stewart's welcome to the guests, Mr. Charles Wilkins, de Havilland (Hatfield) chief designer, averred that if Rumbolds could save 1 lb on each seat of twenty-five 600 m.p.h. 100-seaters, the saving over ten years "would represent 2½ megaton lb" (or £s—Mr. Wilkins did not specify which). W/C. Phillip Morgan, managing director of Eagle Aircraft Services, also replied.

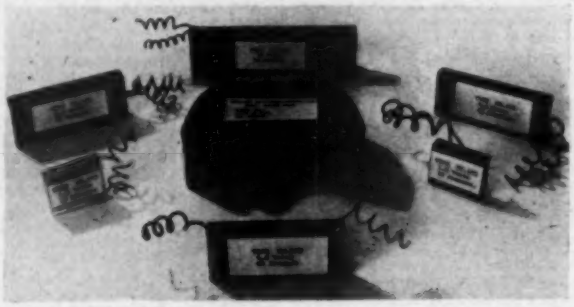
Lightweight Accumulator Progress

A RECENT gathering in London of licensees and concessionaires of the Yardney International Corporation has prompted the publication, by Venner Accumulators, Ltd., of an interesting background story on the silver-zinc accumulator.

The principle of the silver-zinc electro-chemical couple has been known for many years, as has its use as a primary cell capable of one discharge only. Experimental work with the silver-zinc couple has been pursued for many years by Professor Andre of Paris who, before the war, got half-way to his goal by the production of a cell which was rechargeable to a useful number of cycles, but in which, unfortunately, the electrodes were soluble, so that the life of the cell was accordingly limited.

Since those early days great advances have been achieved. In 1948 Mr. Michel N. Yardney, now president of the Yardney International Corporation of New York, obtained the world rights for the production of silver-zinc cells, as he foresaw the possibilities of a lightweight high-capacity cell which could be accommodated in a very limited space and be capable of extremely high rates of discharge.

Since 1948 manufacturing licences have been granted in Canada, England, France and Germany, and concessionaires appointed in nine other countries. Venner Accumulators, Ltd., became licensees in January 1948. Progress since then has been continuous, and the capacity range of their batteries has constantly increased. One



Venner resin-encapsulated silver-zinc accumulators.

of the latest advances is in the field of miniature H.T. packs, which are suitable for numerous applications, notably in missile electronics. Among the latest developments is the Type HT 125 cell, designed for resin-potting in strips of up to ten. Nominal capacity is 0.125 Ah, for discharge over a current range of from 10 to 500 mA.

IN BRIEF

The General Electric Co., Ltd., announces three-year contracts by the Air Ministry for the supply of vapour-proof fluorescent lighting fittings, and for the supply of lighting fittings for officers' married quarters at R.A.F. stations in the U.K. and overseas.

* * *

Mr. Ken S. John, formerly with Export Packing Service, Ltd., has joined R. and H. Wale (Joinery), Ltd., as sales manager and in his new capacity will be concerned with sales promotion of the company's joinery and packaging activities.

* * *

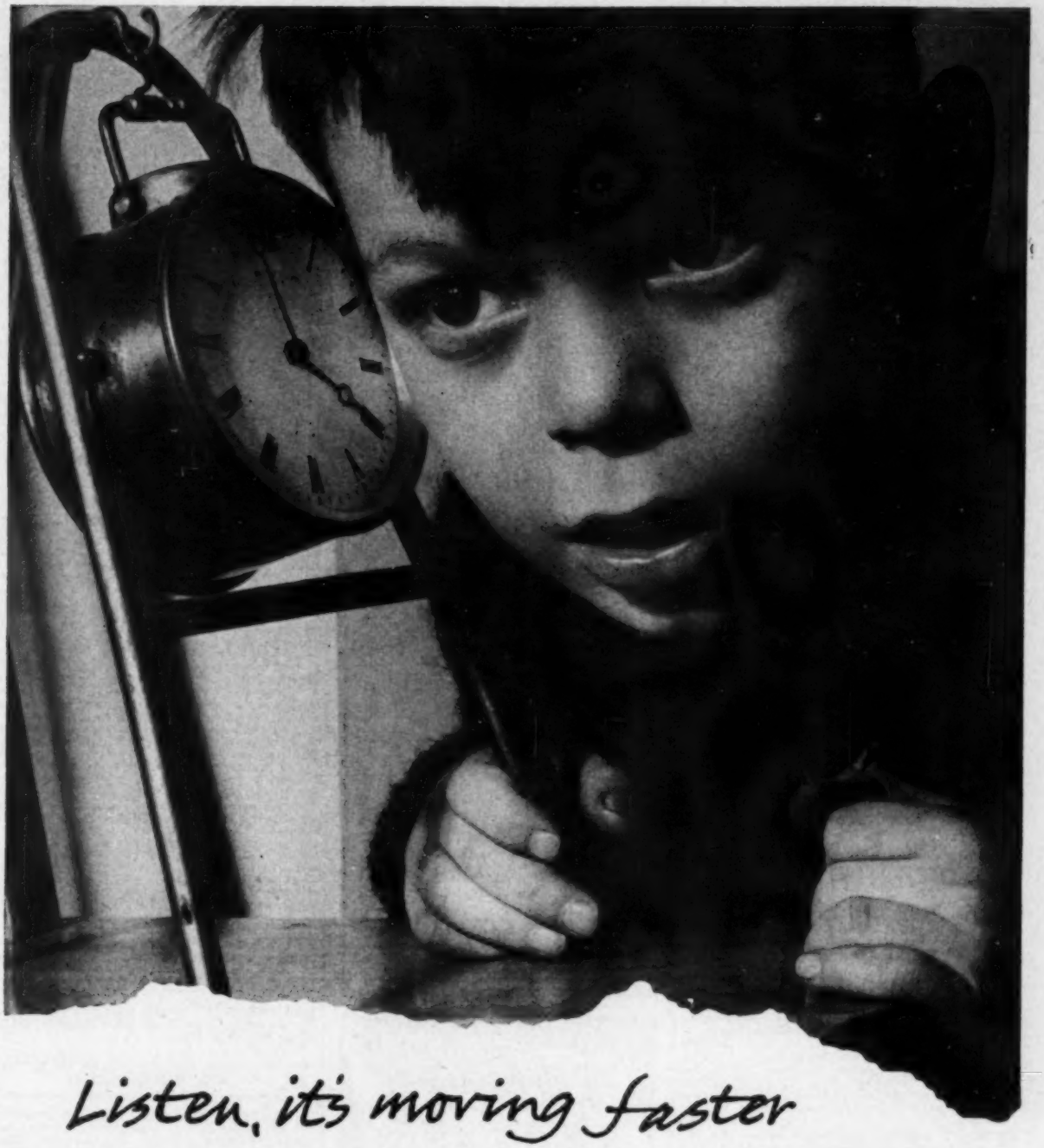
Mr. H. L. Ginaven, director of production at the Wolverhampton, Glasgow and Wallasey factories of the Goodyear Tyre and Rubber Co. (Great Britain), Ltd., is returning to the United States shortly. He is being succeeded by Mr. John Q. Shaul, who is expected to arrive in this country during June and whose present appointment as superintendent at Plant 2 of the American Goodyear company in Akron will be taken over by Mr. Ginaven.

* * *

We regret to record that Mr. G. C. Cunningham, O.B.E., joint managing director and a founder director of Racal Engineering, Ltd., died on May 16. He was with Imperial Airways before the war, and during it served with the R.A.F., being associated with the formation of the North Atlantic Ferry Command as Deputy Chief Signals Officer in Canada. In 1945 he was appointed signals controller of B.O.A.C., remaining with the Corporation until 1950.

* * *

In ten weeks, from the date of beginning work at Gatwick Airport to major completion of the contract, Crompton Parkinson, Ltd., supplied and installed approximately 30 miles of cable for the 11 kV ring main, M.V. distribution network and pilot and control cables system interconnecting the distribution centres. Delivery of the cables began within three weeks from confirmation of the order, after a "maximum effort" call to Derby Cables, Ltd., a subsidiary of the company.



Listen, it's moving faster

He lives in a fast-moving age. Already, achievements meriting a century's span are crowded into his short lifetime. And still—as men extend their knowledge almost to the threshold of Space—the tempo quickens. Quick enough for *him* to see men's most daring ambition realised? That is still not certain. But this International Geophysical Year must bring such an achievement measurably closer.

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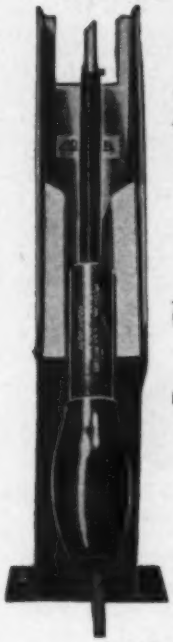

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APPLICATION No. 203/7 from Hunting-Clan Air Transport, Ltd., of London Airport, Hounslow, Middlesex, for an amendment to the terms of approval of the All Freight Service which they are authorised under Applications Nos. 203, 204 and 205 to operate between points in the United Kingdom and points in East, Central, West and South Africa, so as to enable them to operate with DC.6A aircraft in addition to the types already authorised.

THIS application will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to this application must be made in writing, stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [7928

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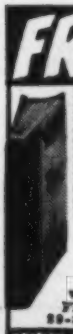

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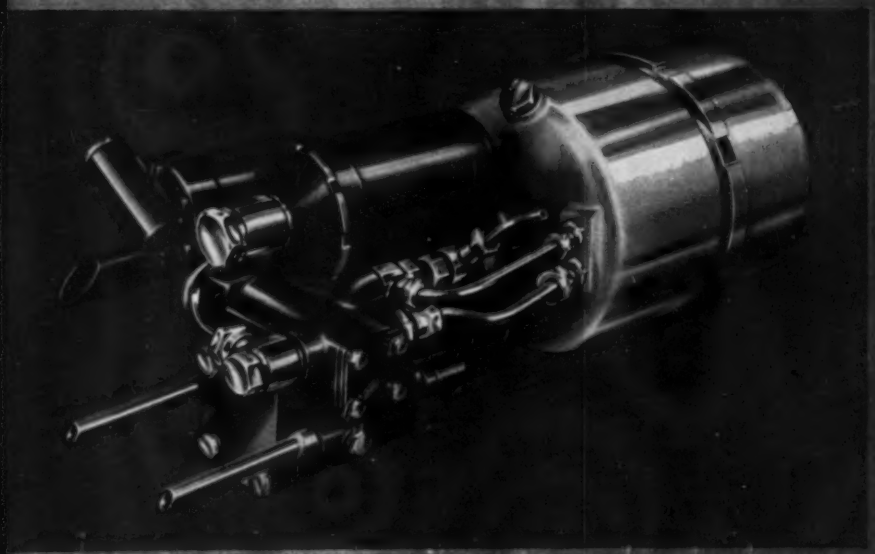

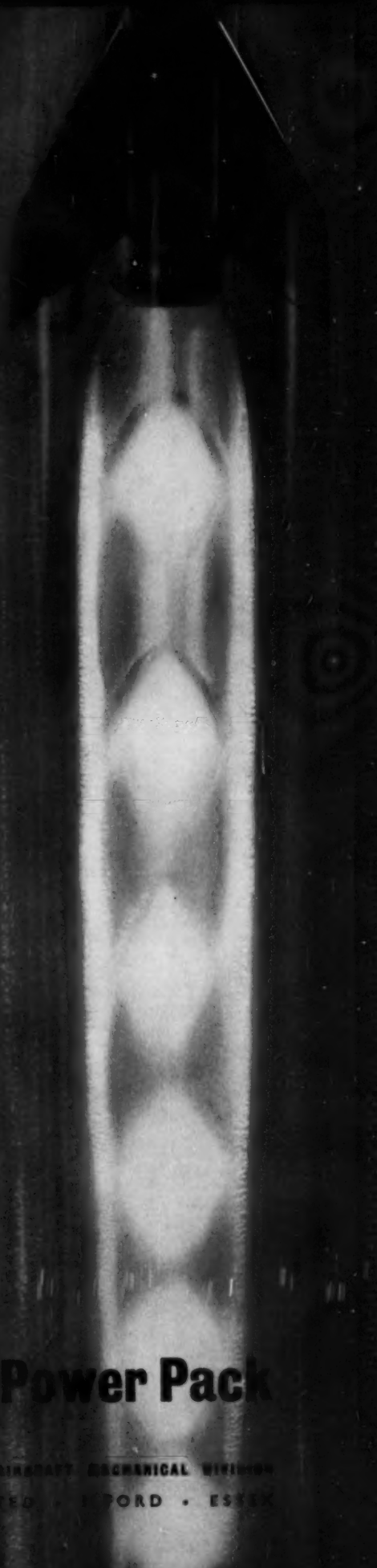

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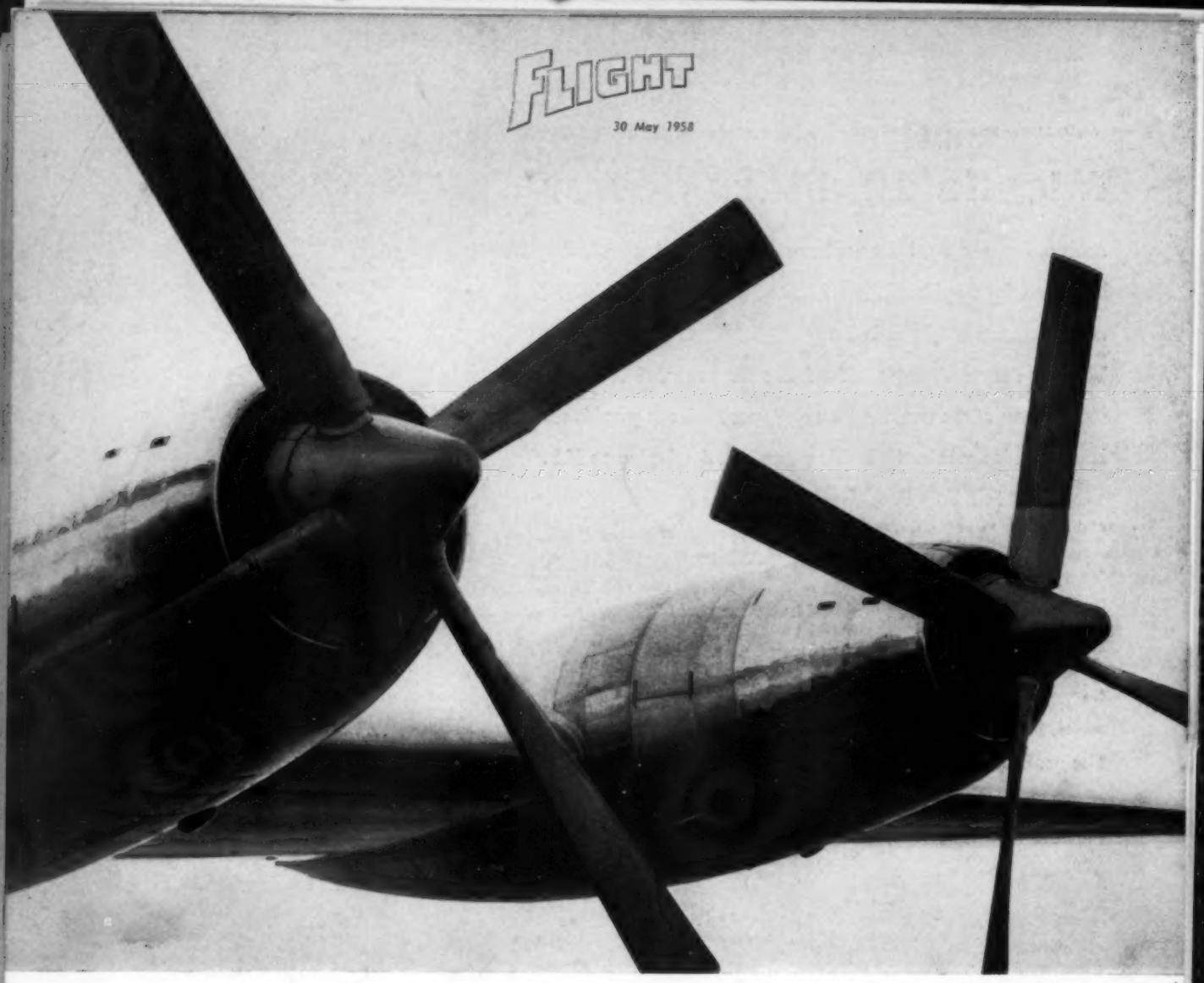

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